Conceptual design of the AGATA setup at PRESPEC

GSI-Gamma-Ray Spectroscopy Group, Prespec- & AGATA-Collaborations

C. Domingo Pardo

GSI Helmholtzzentrum für Schwerionenforschung GmbH

AGATA Week, Lyon **24.10.2010**

Outline

- Overview of the AGATA environment at GSI FRS (PRESPEC)
- Expected AGATA performance in terms of efficiency and resolution
- Performance vs. number of double and/or triple cluster available
- Effect of the lead (background) absorber
- Angular dependence of the g-ray efficiency for several distances
- Lifetime measurement via the line-shape effect
- Conclusion

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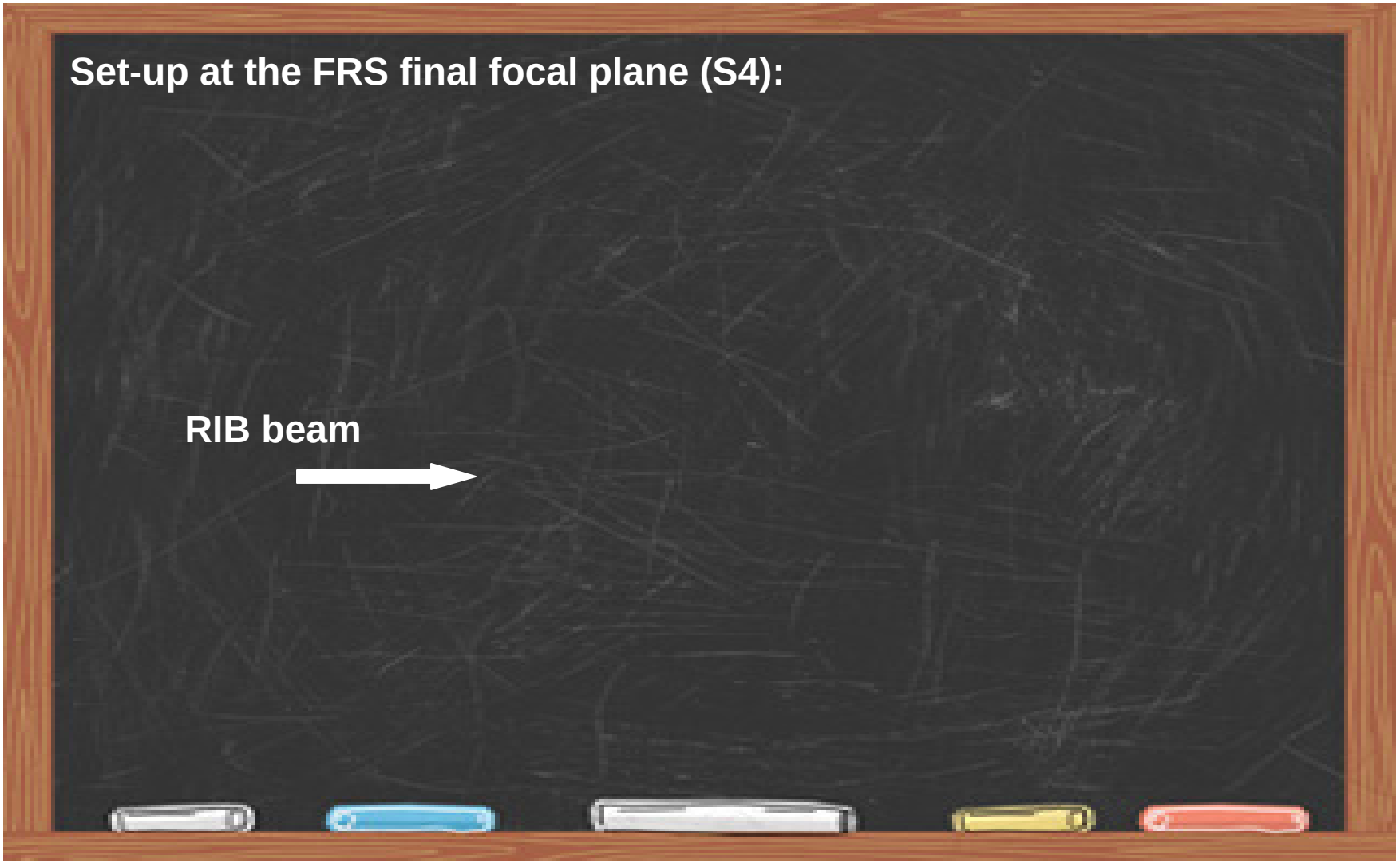

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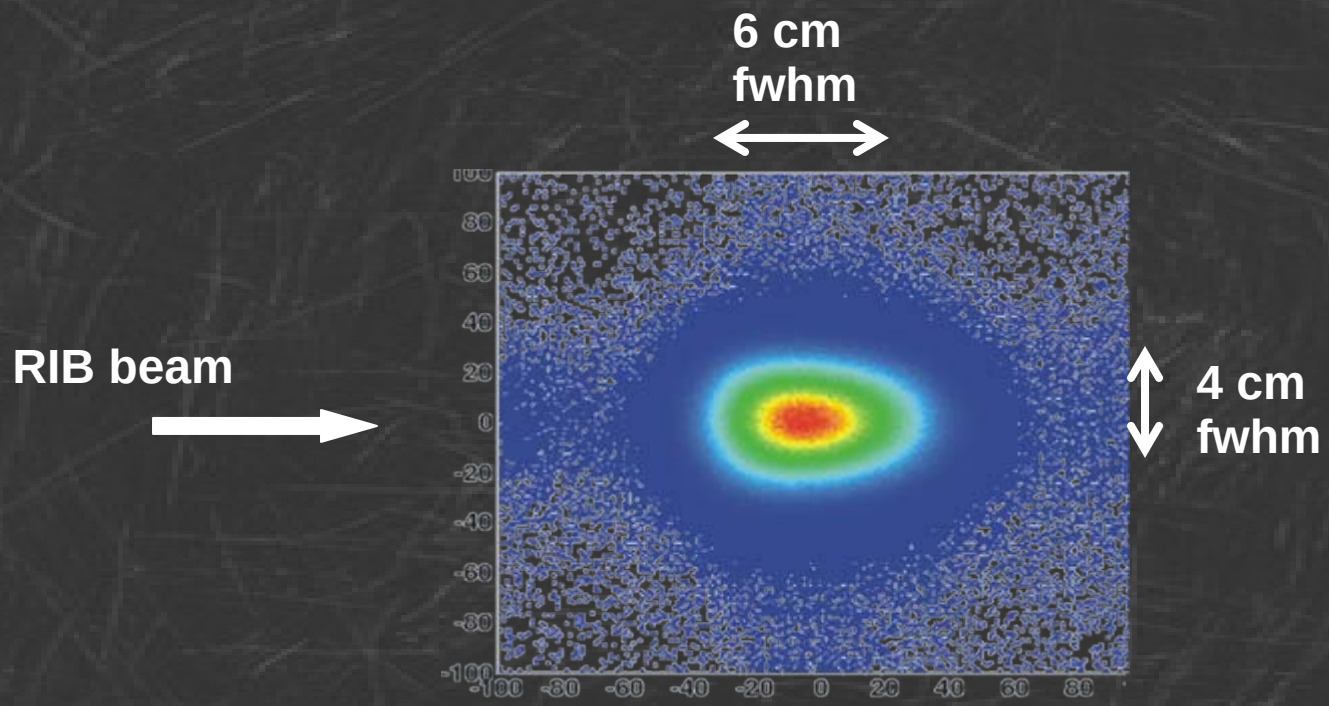
Set-up at the FRS final focal plane (S4):



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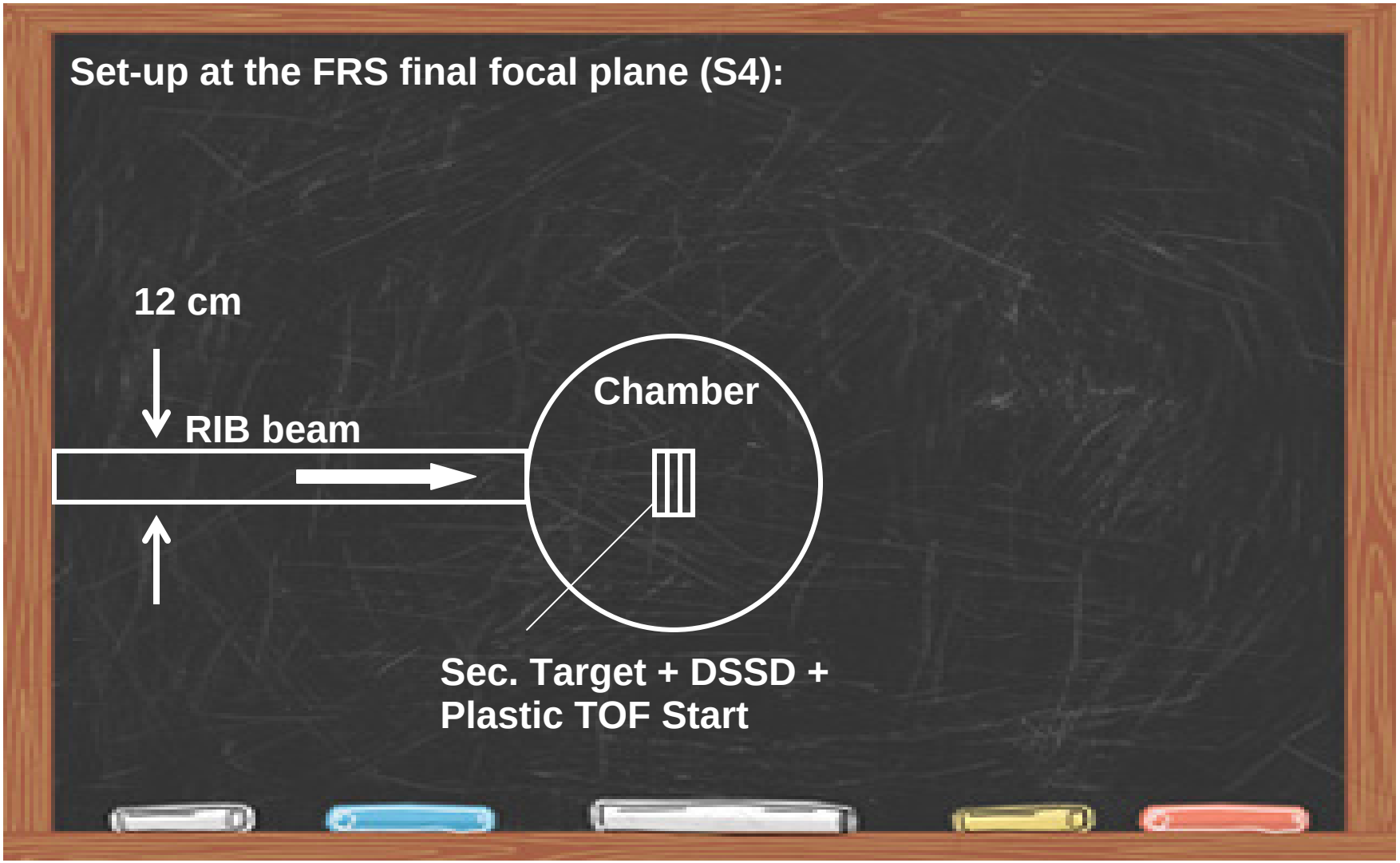

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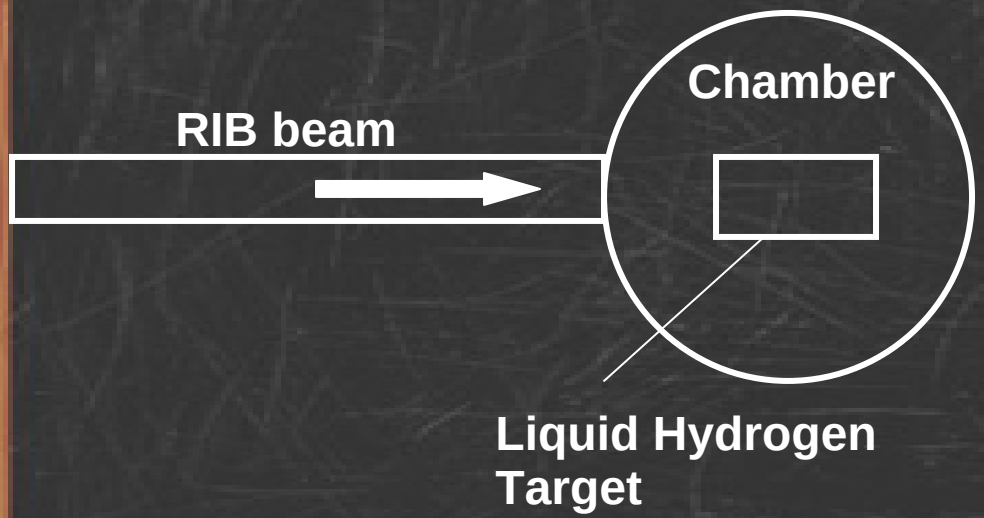

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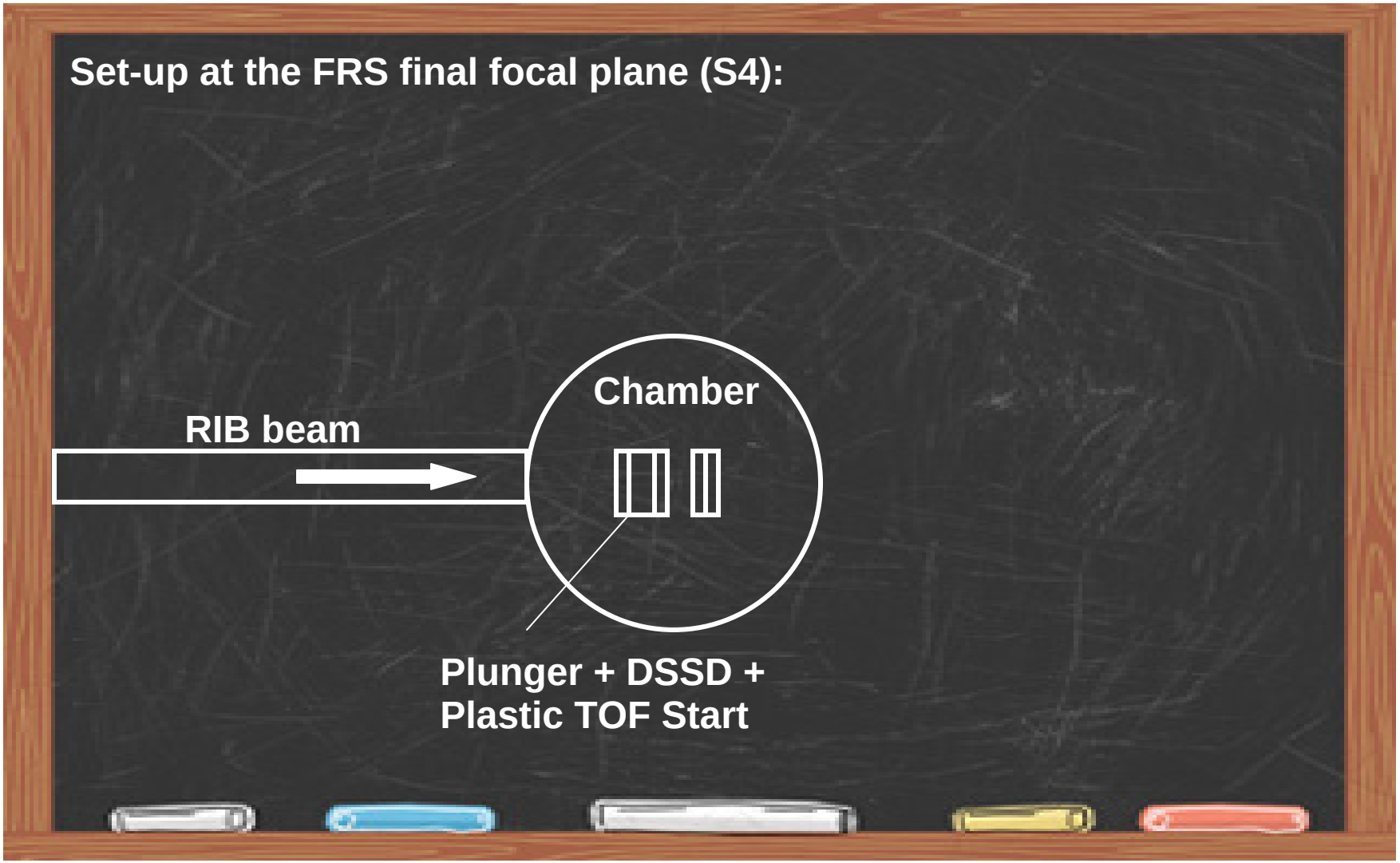

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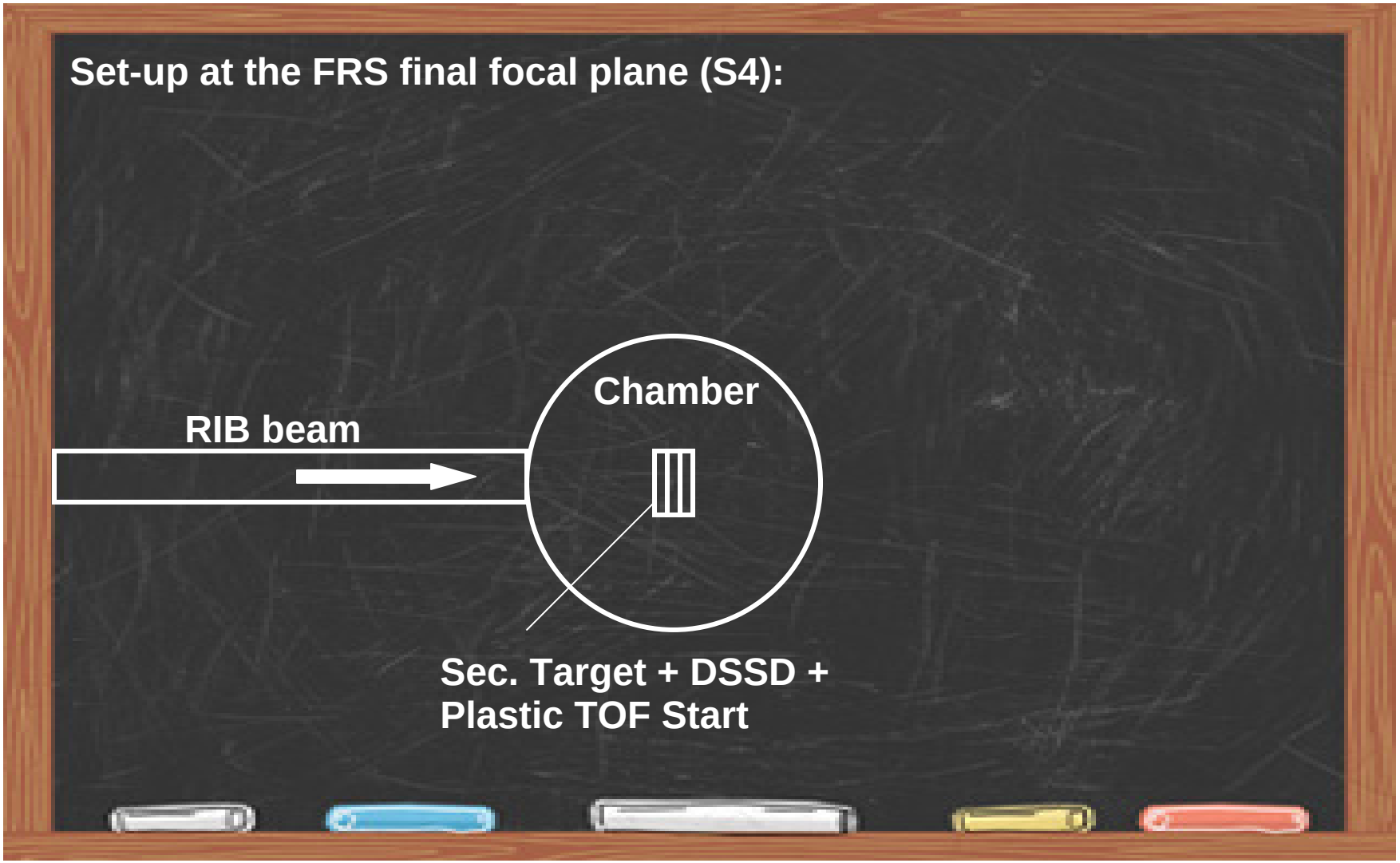

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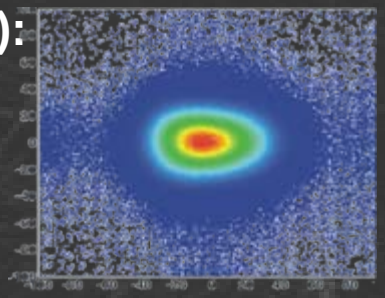

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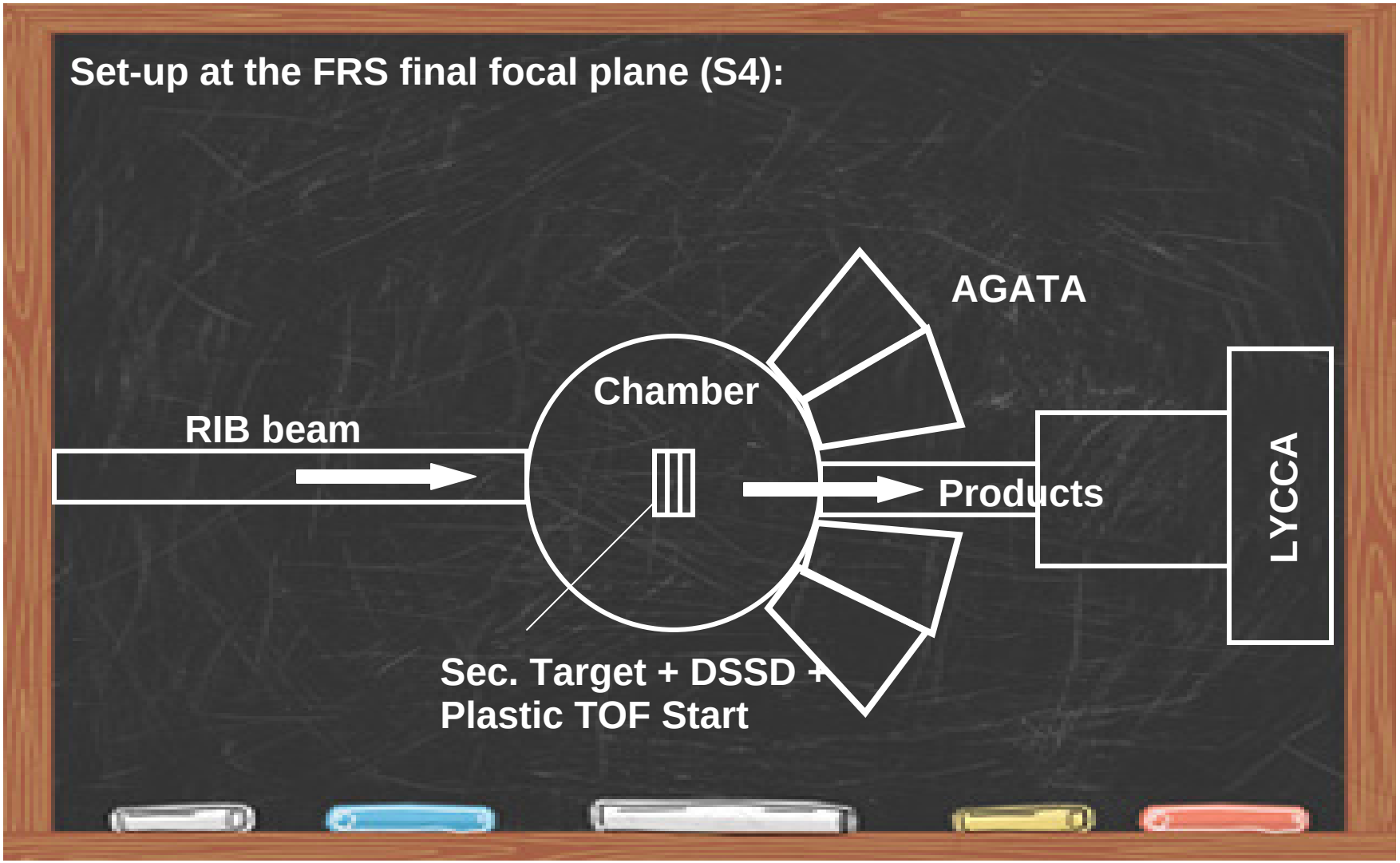

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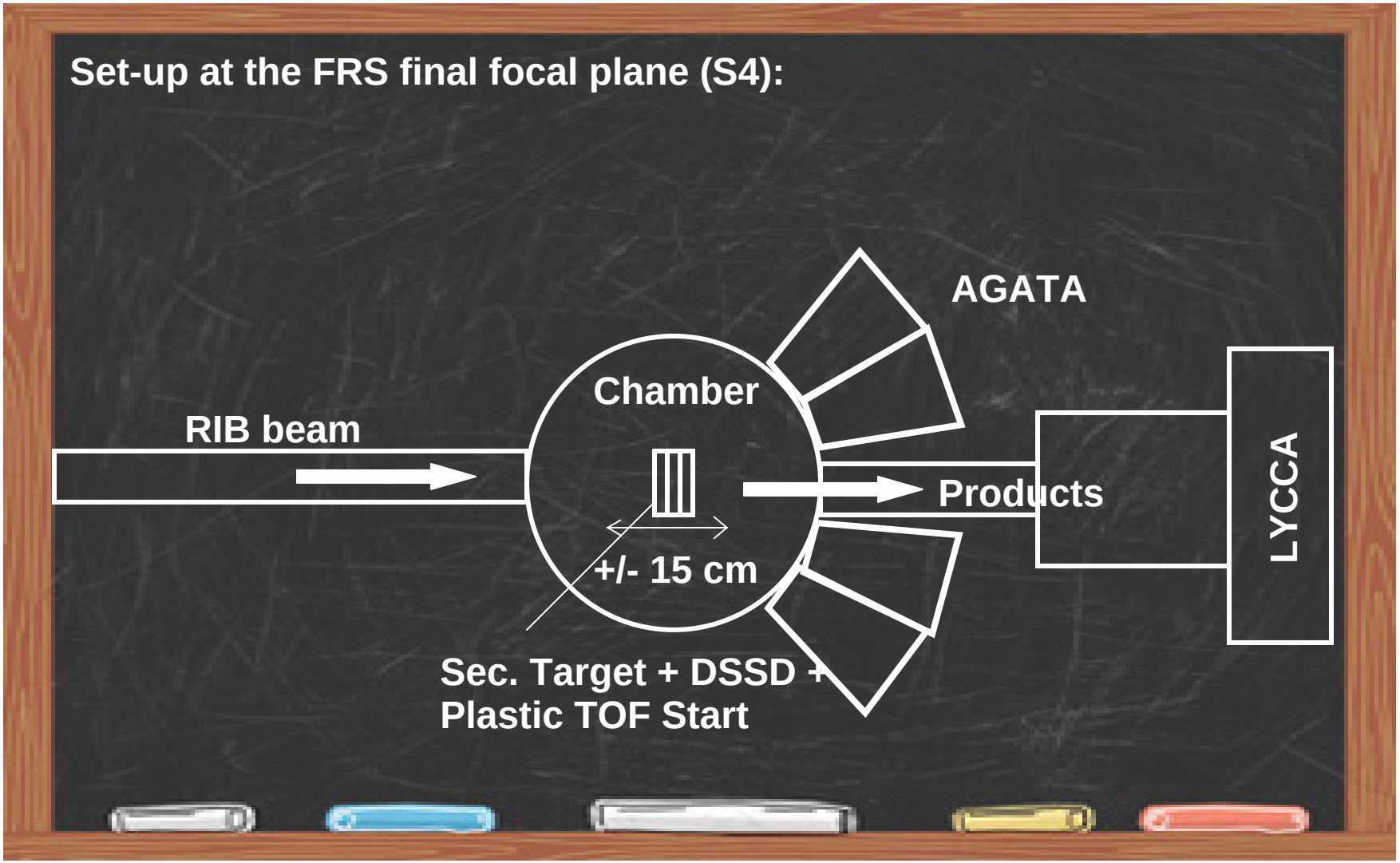

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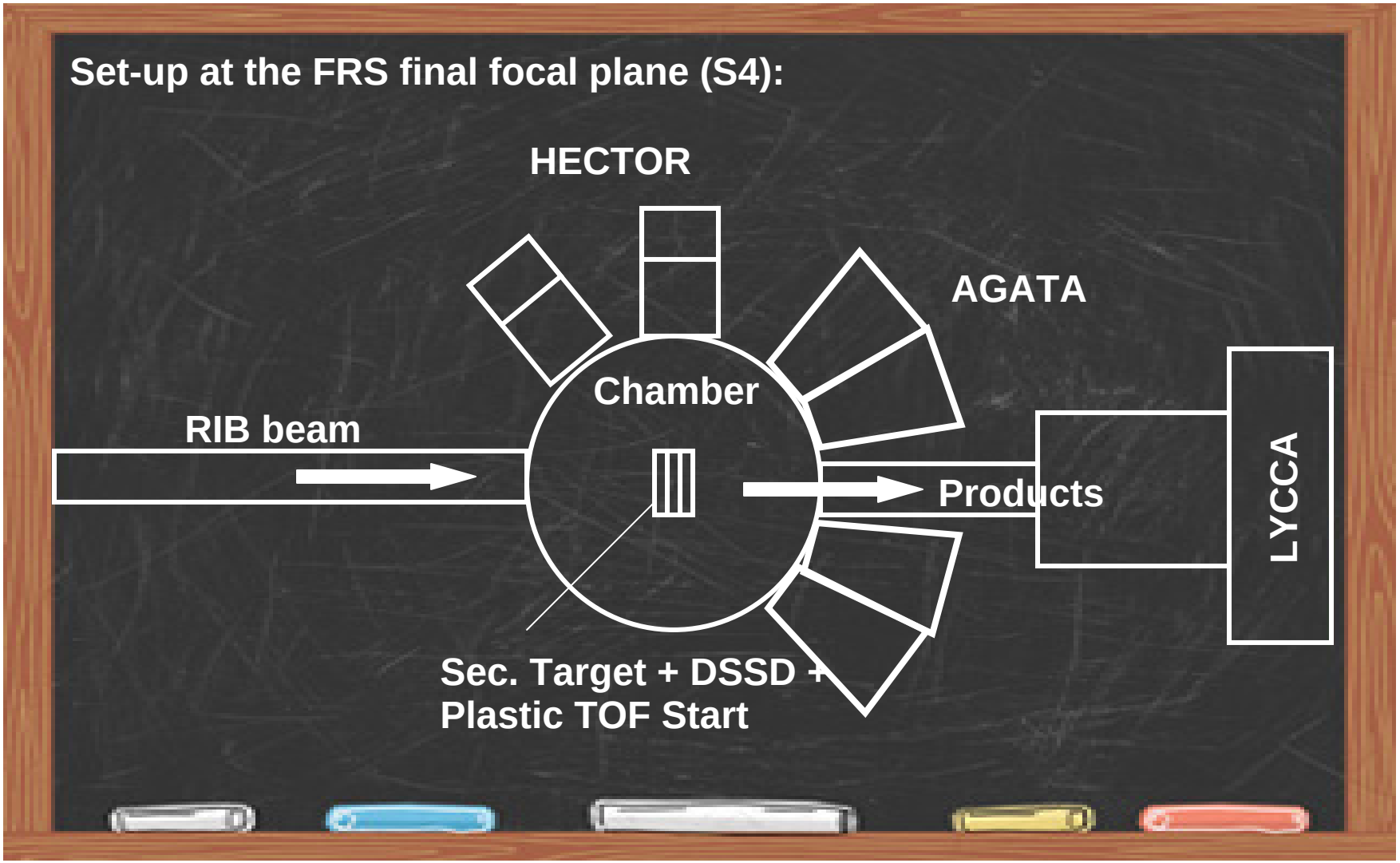

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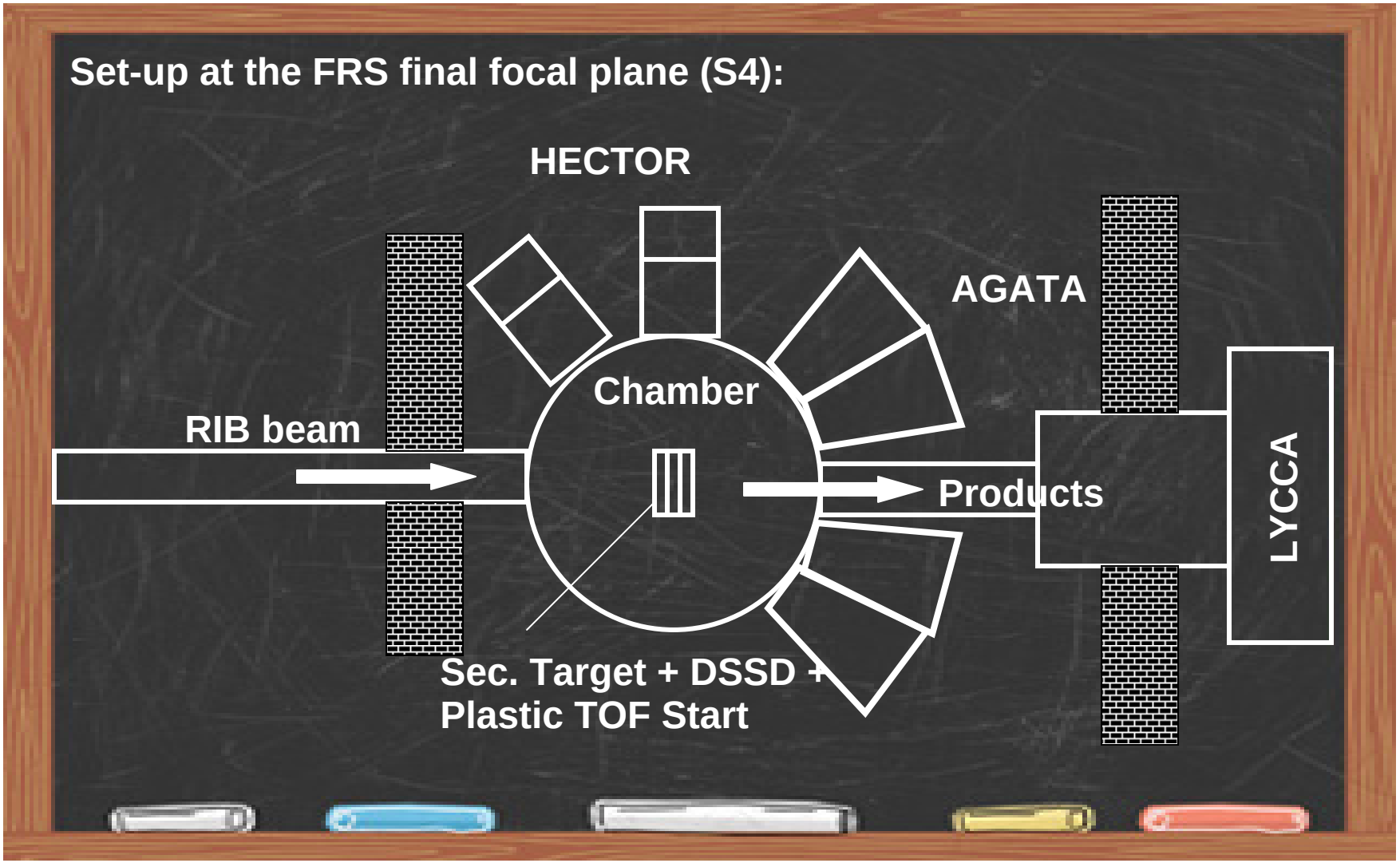
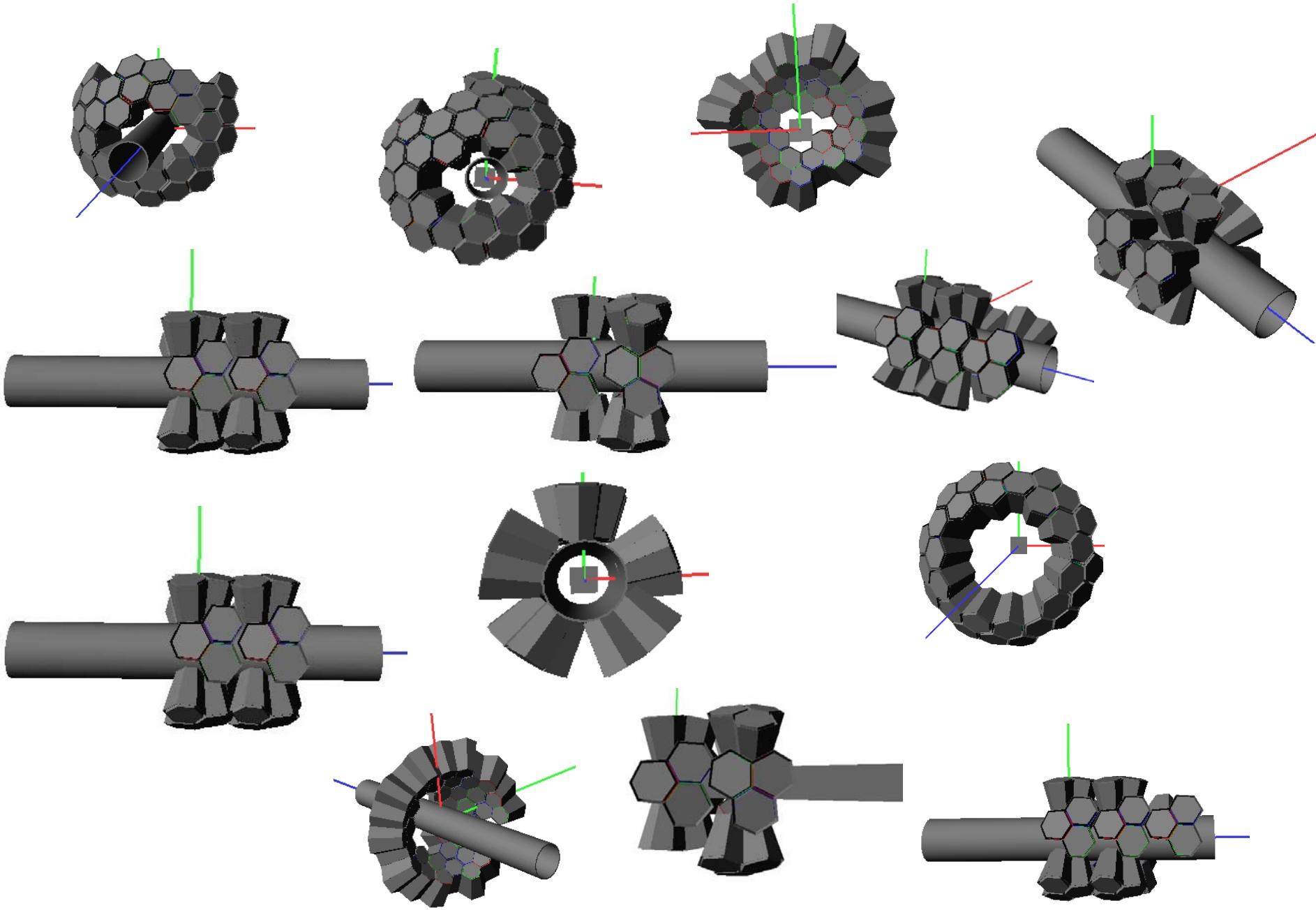


Which is the right one?...



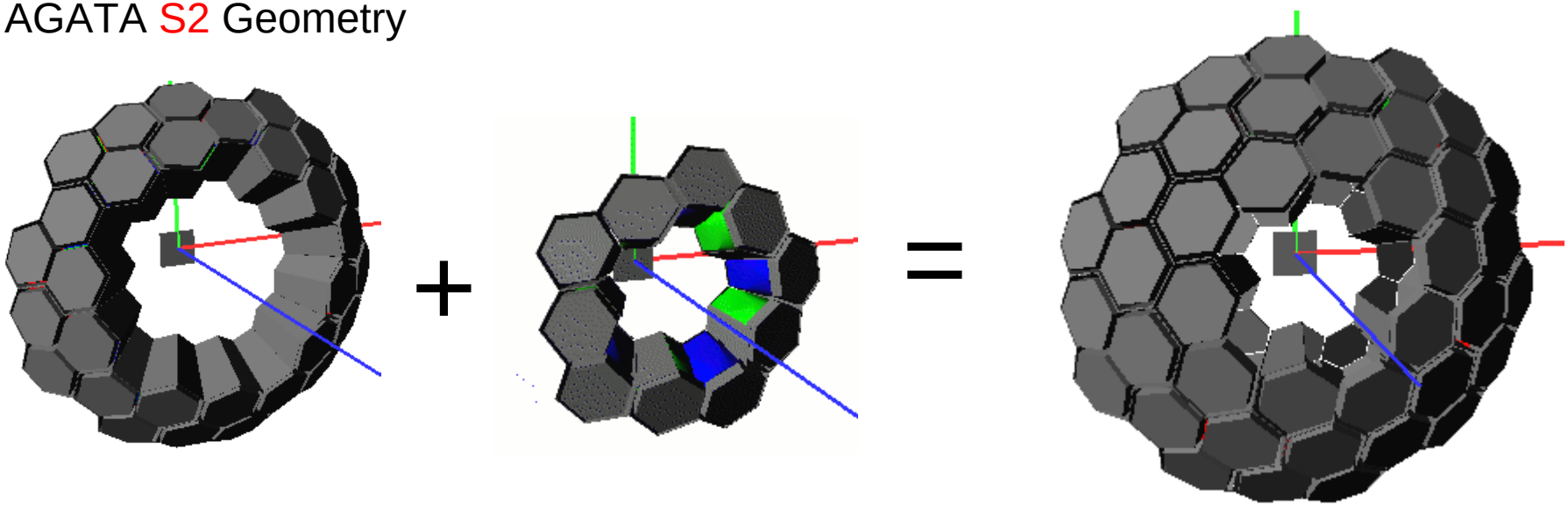
AGATA S2' = 10 ATC + 5 Double Cluster Detectors

Geometry cases

- S2 + 5 Double Cluster detectors closing part of the central hole (15-16cm?). Remains shell with 5 crystals hole + pentagon hole

AGATA S2 Geometry

AGATA **S2'** Geometry



10 triple Cluster + **5 double** Cluster

Beam pipe diameter = 9 - **12** cm

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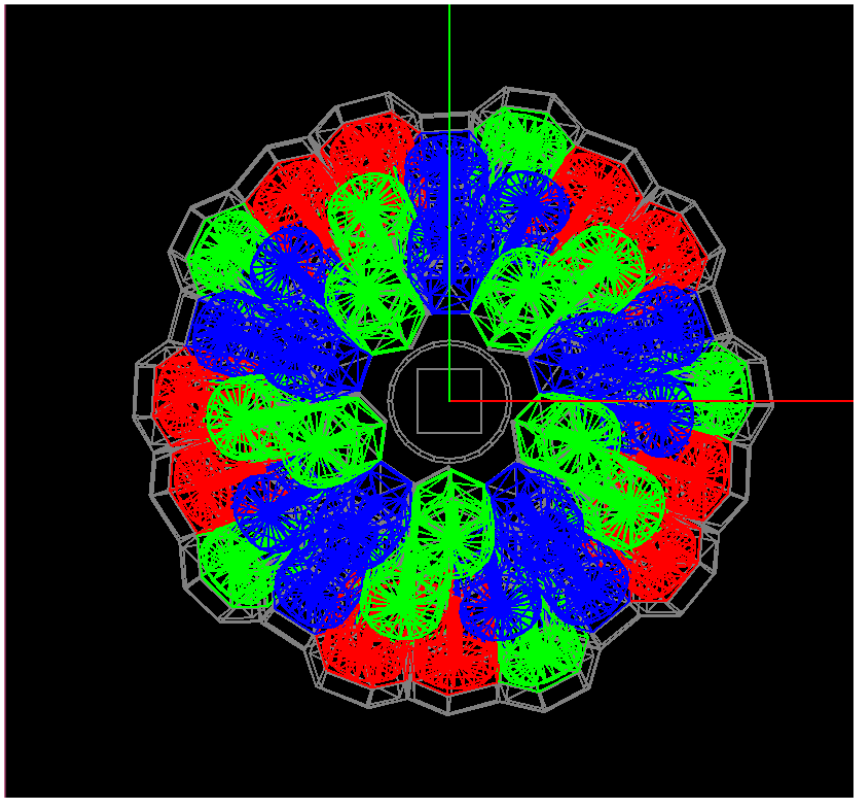
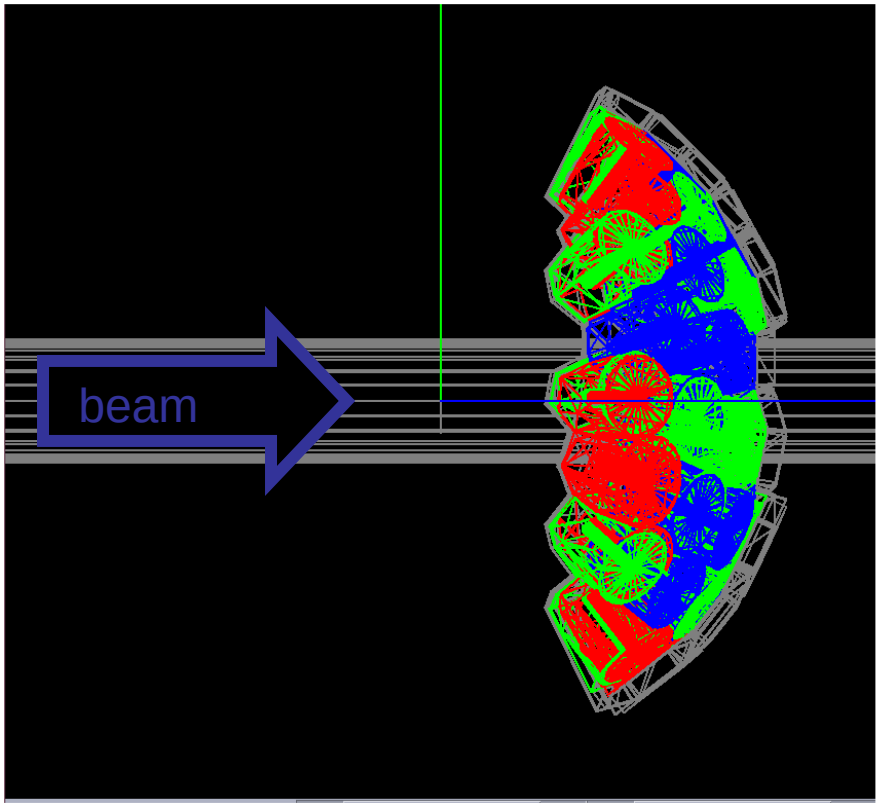
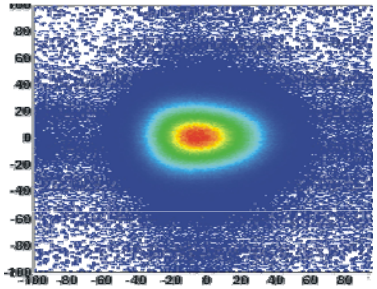
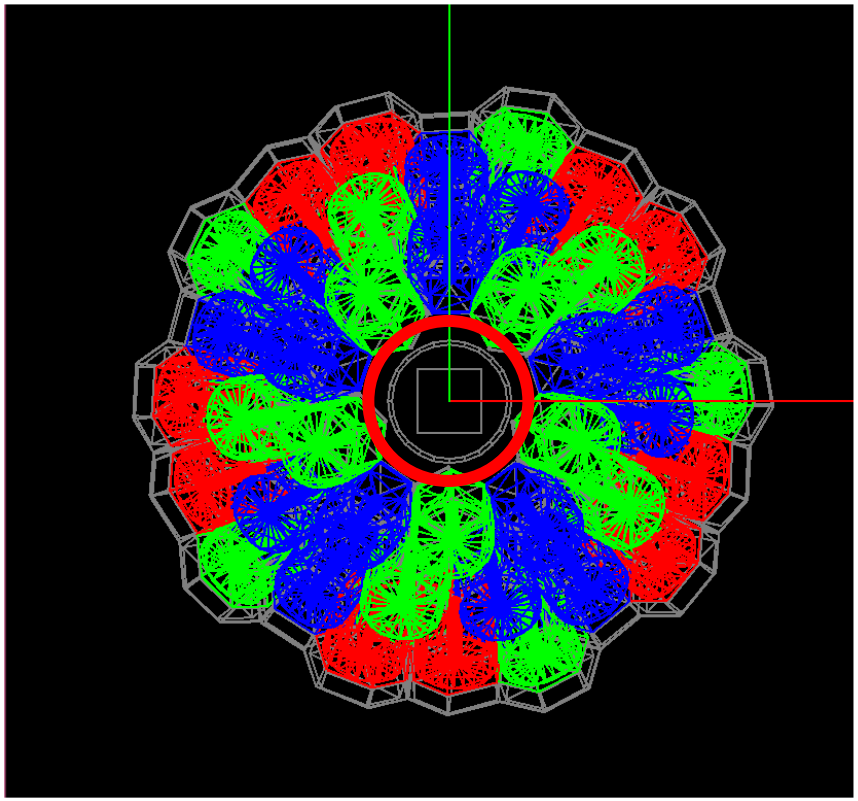




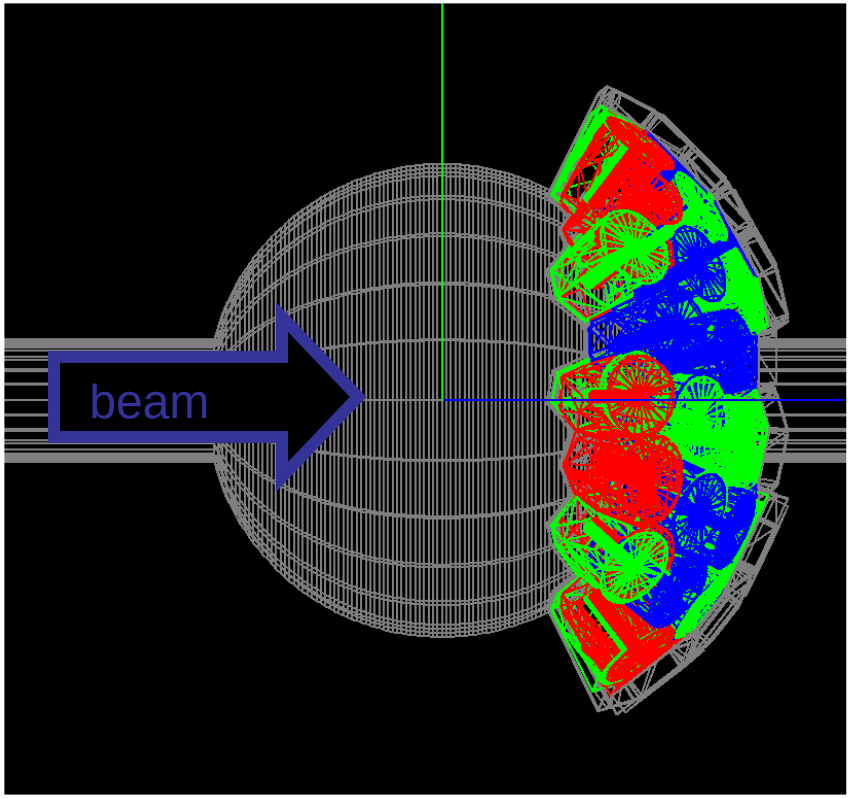


AGATA S2' = 10 ATC + 5 Double Cluster Detectors

Blue crystals are at diameter = 17 cm



Room for a chamber 46cm diameter



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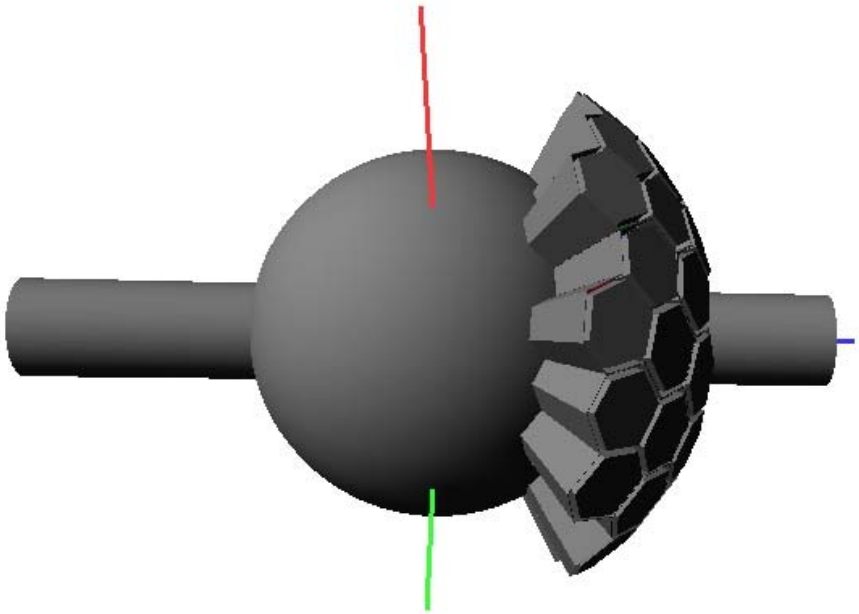
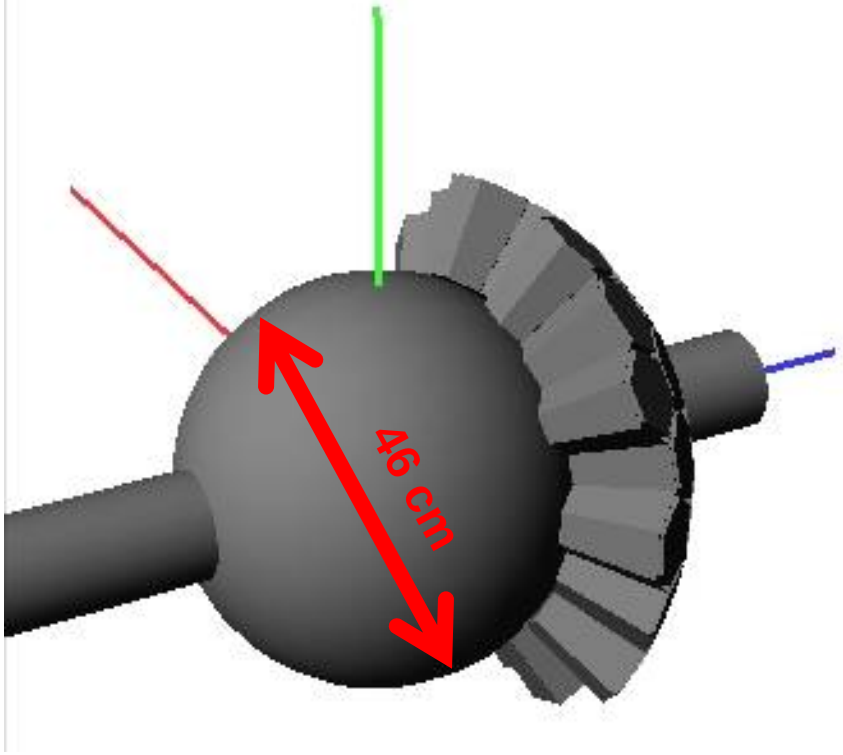
- S2’ Geometry + Spherical Chamber





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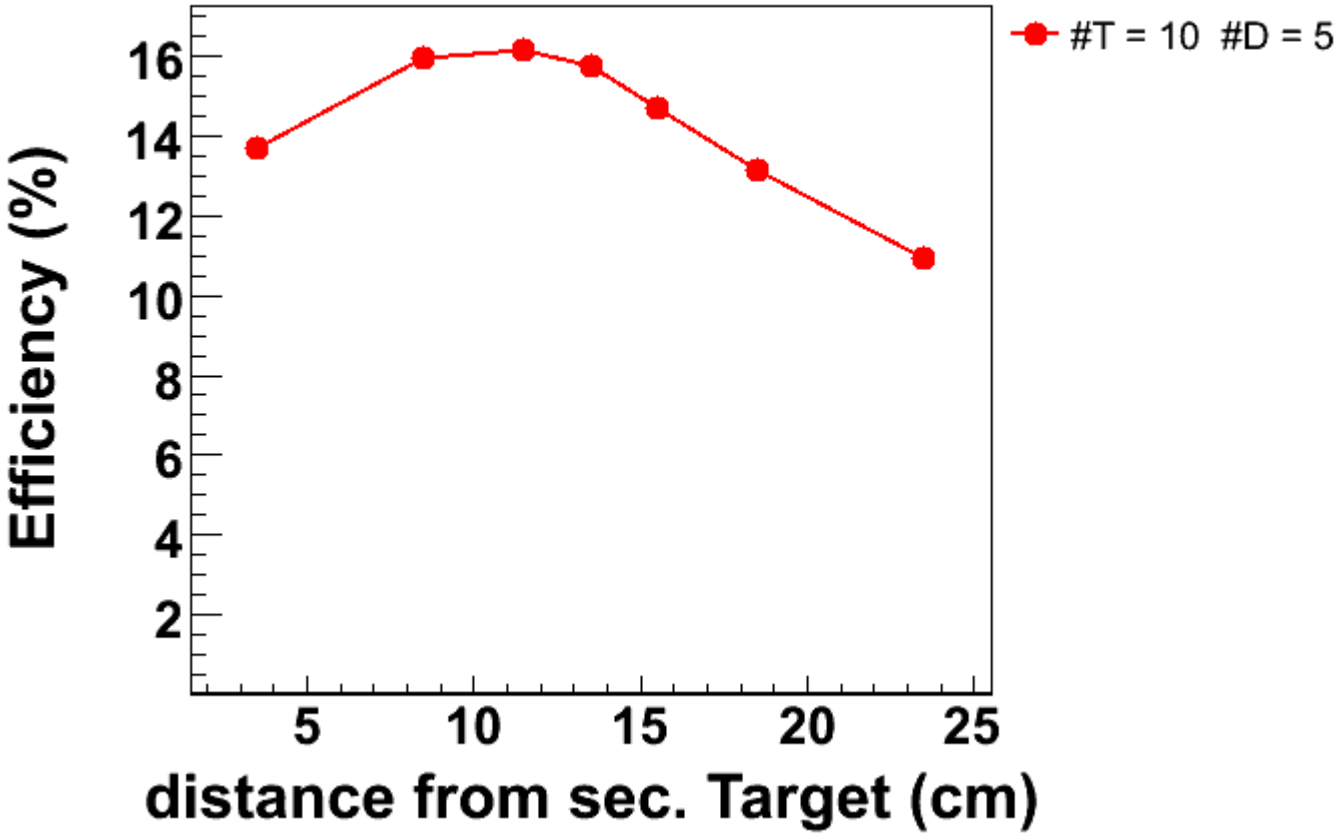
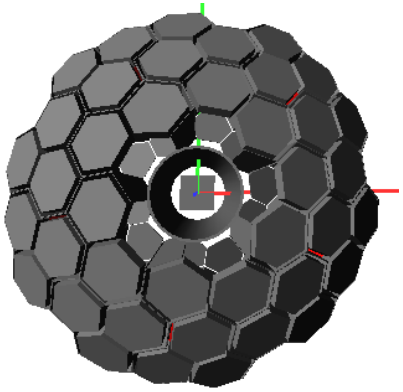
(GEANT4 AGATA code from NIMA 621 (2010) 331-343, E.Farnea et al.)





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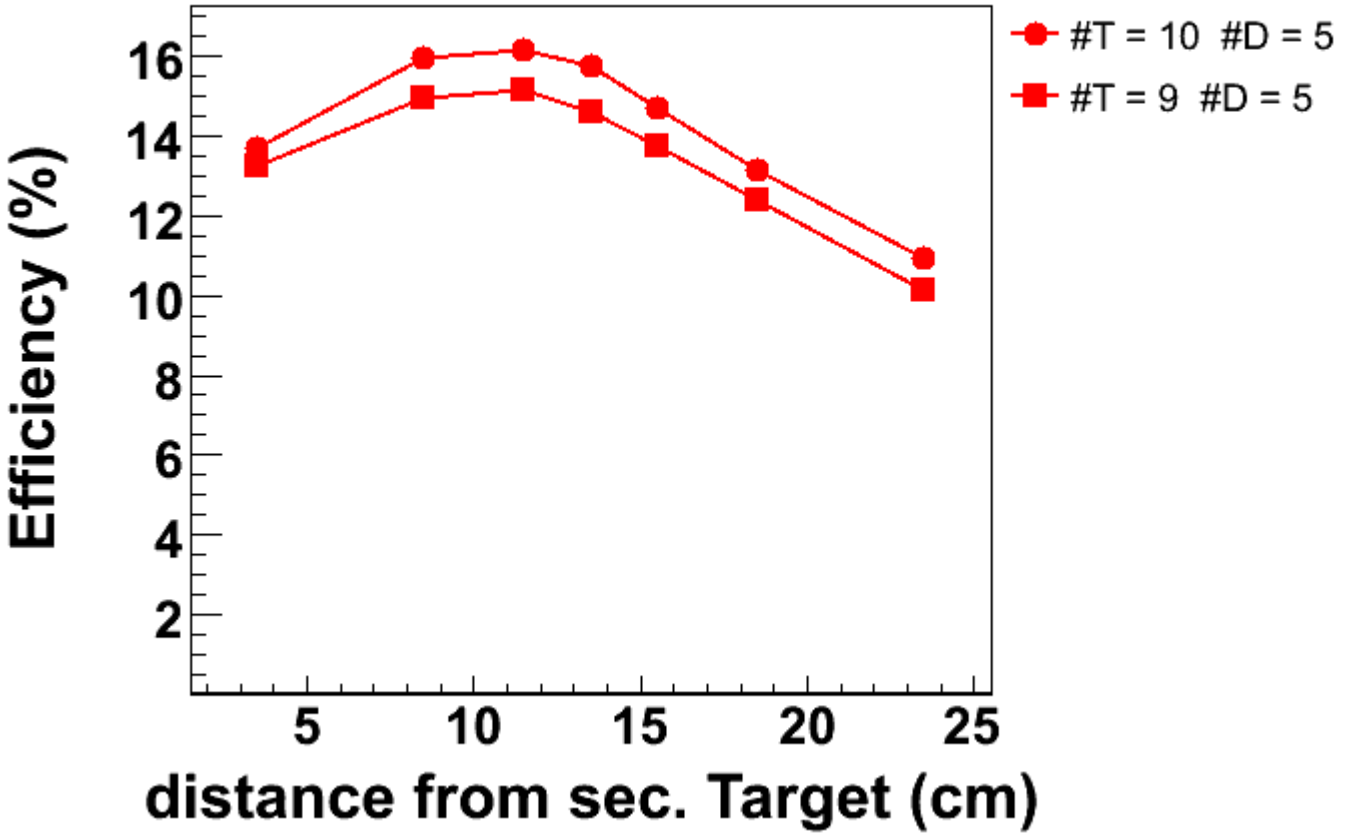

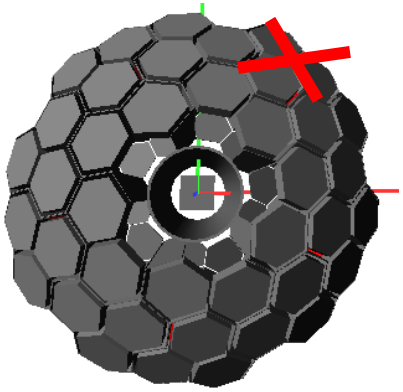

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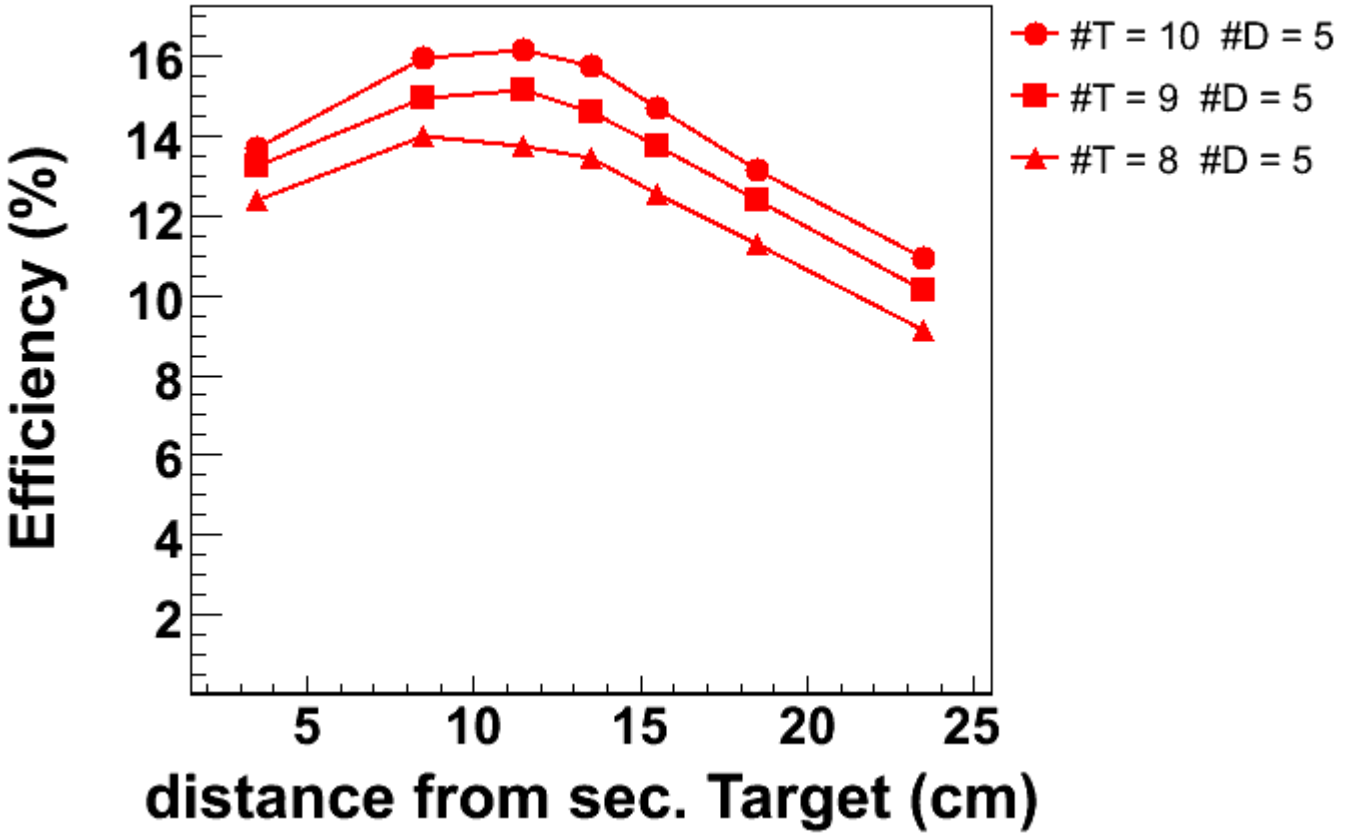

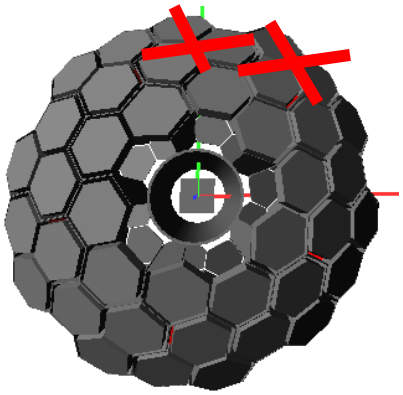

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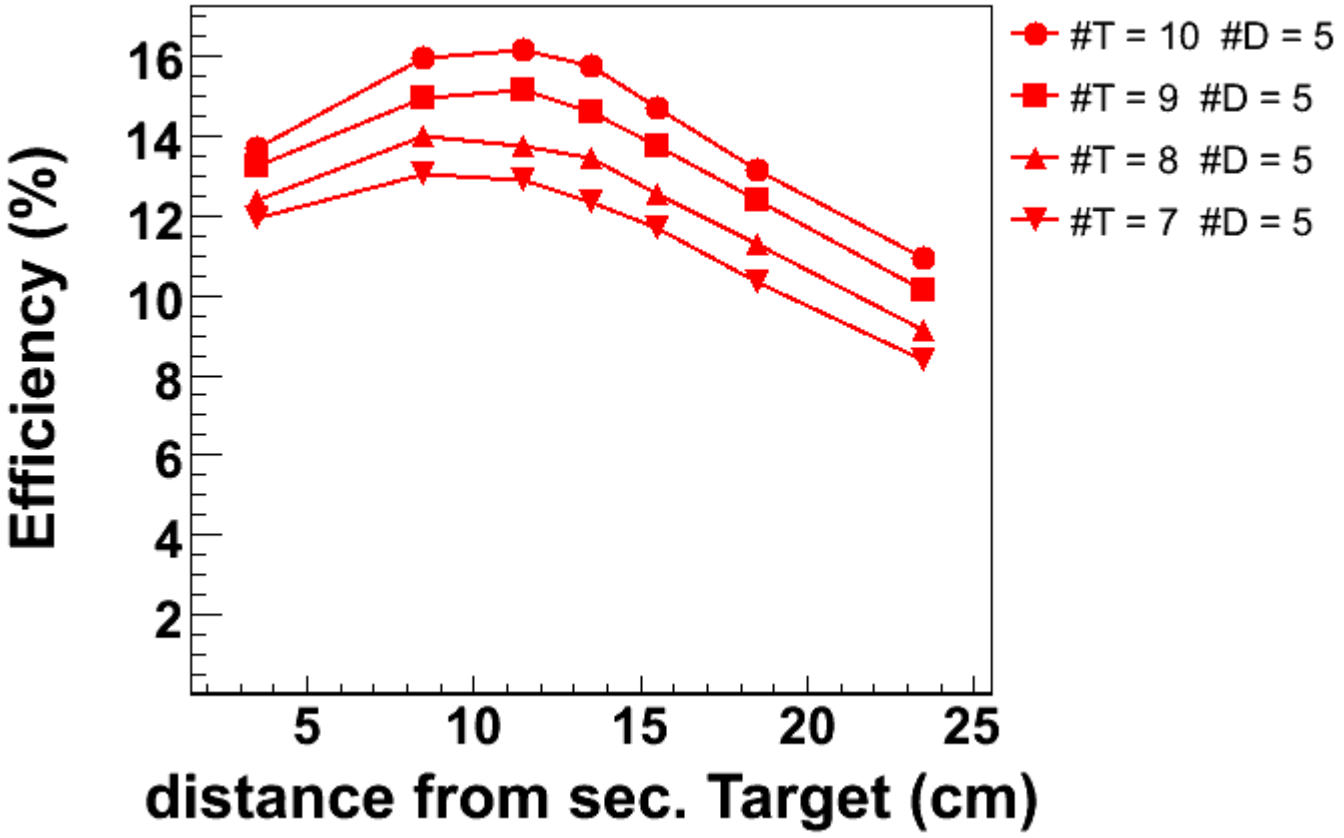

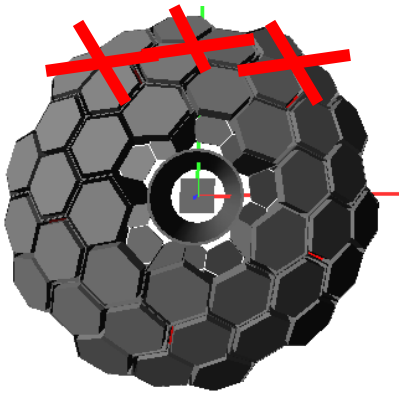

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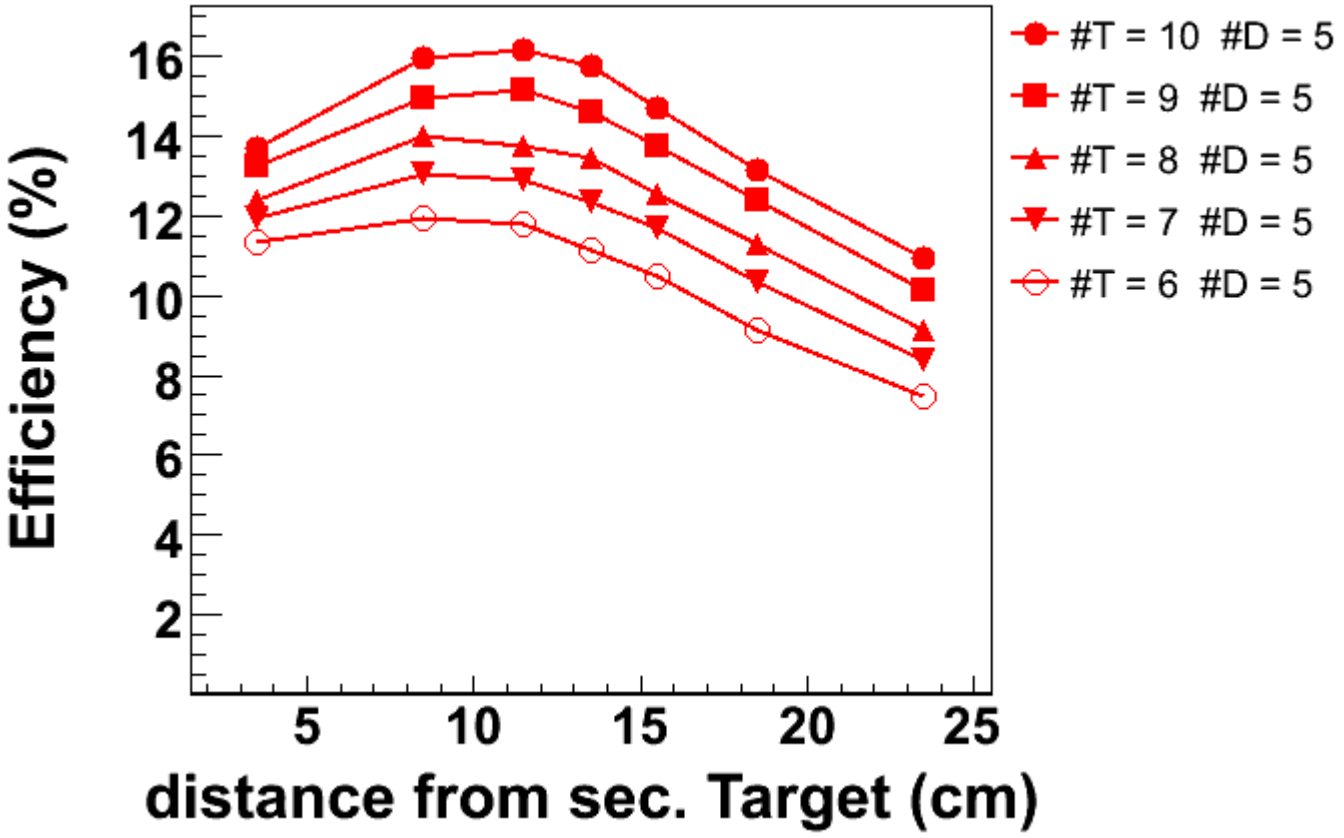

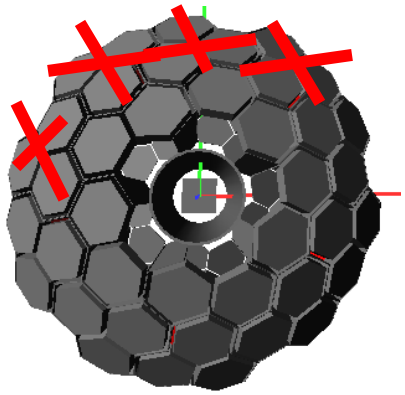

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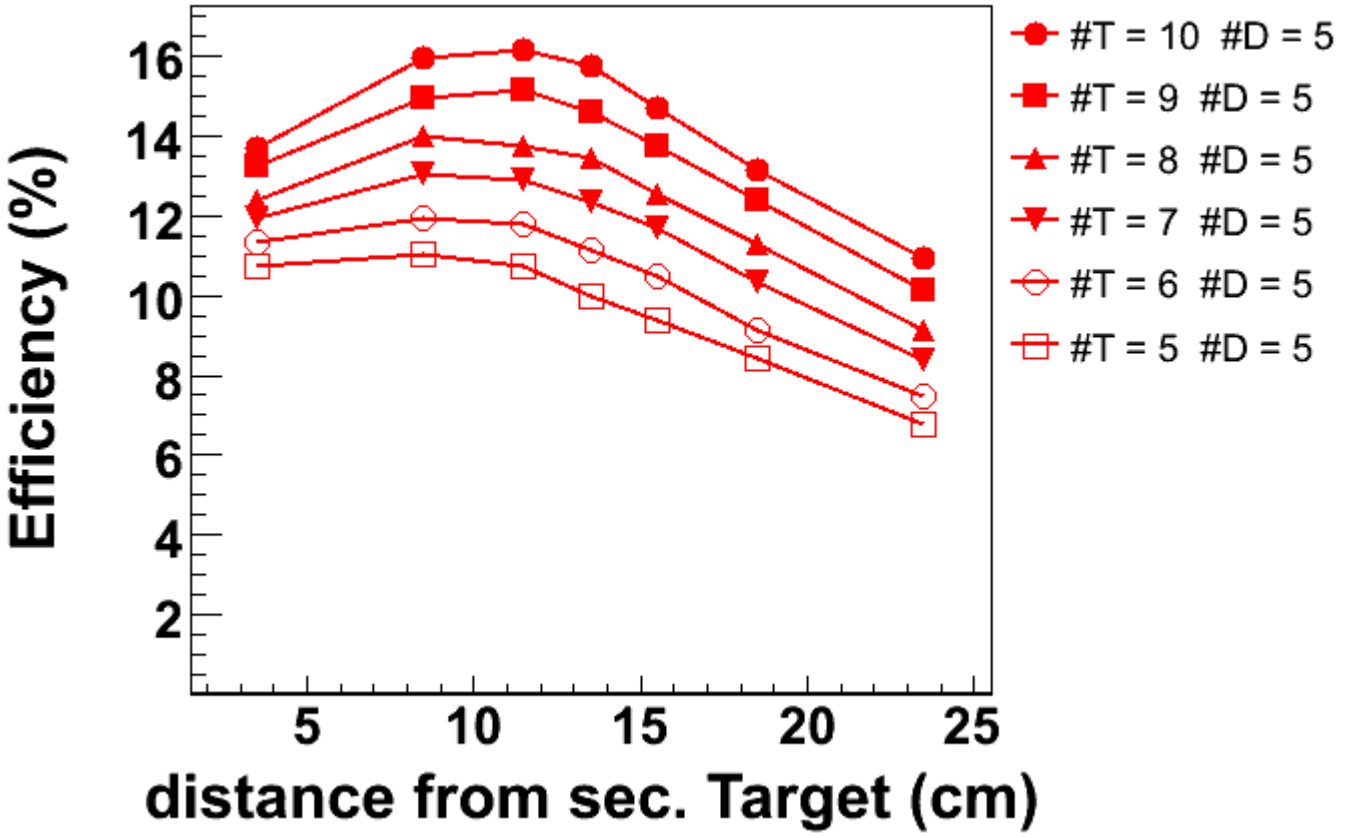

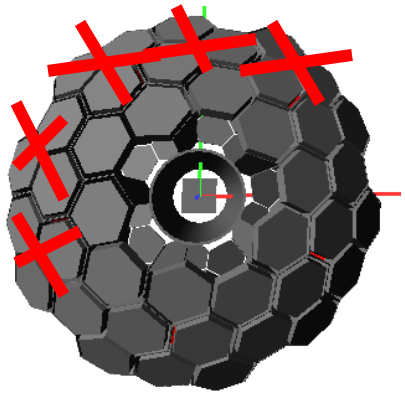

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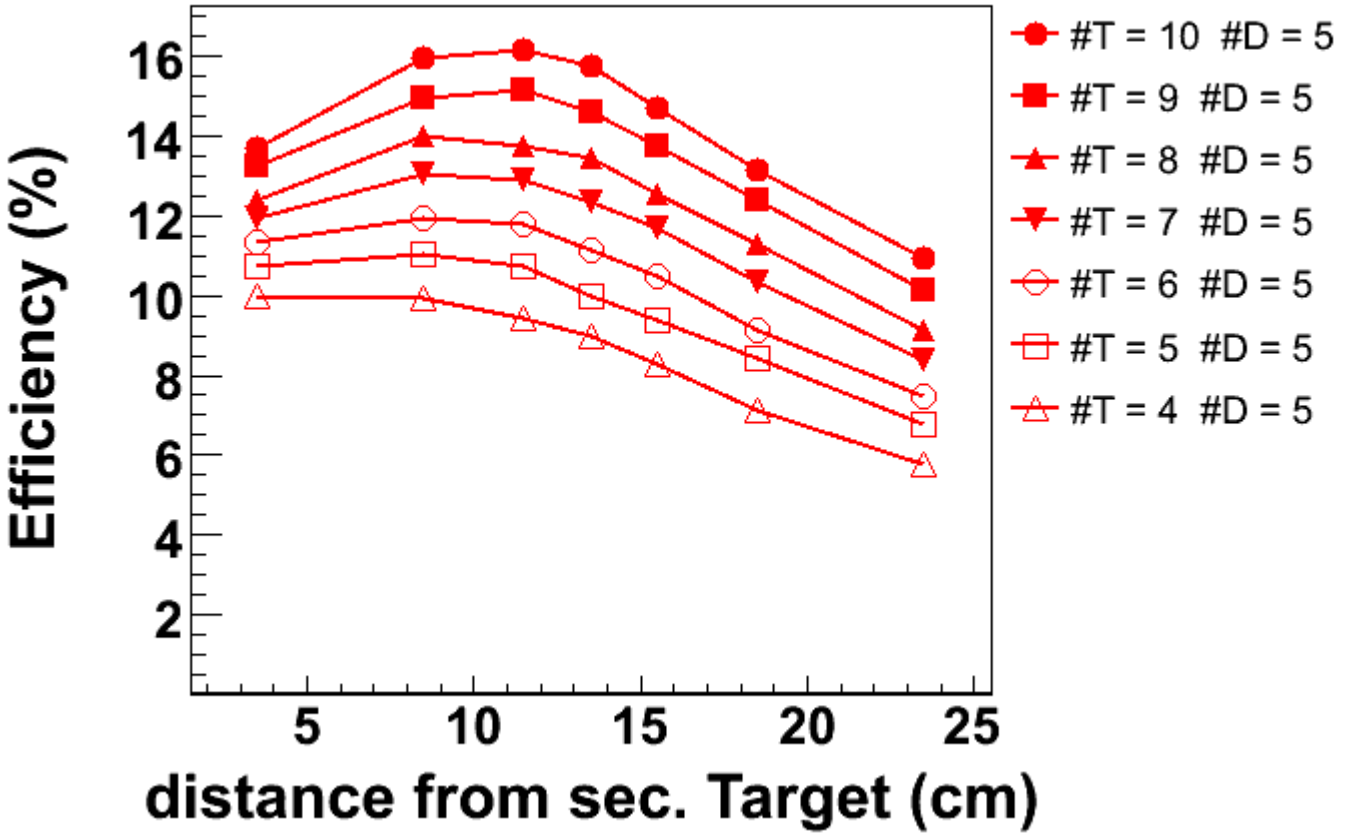

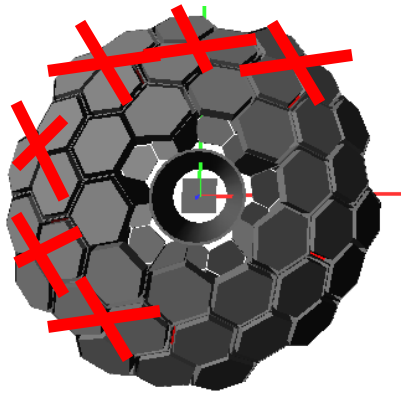

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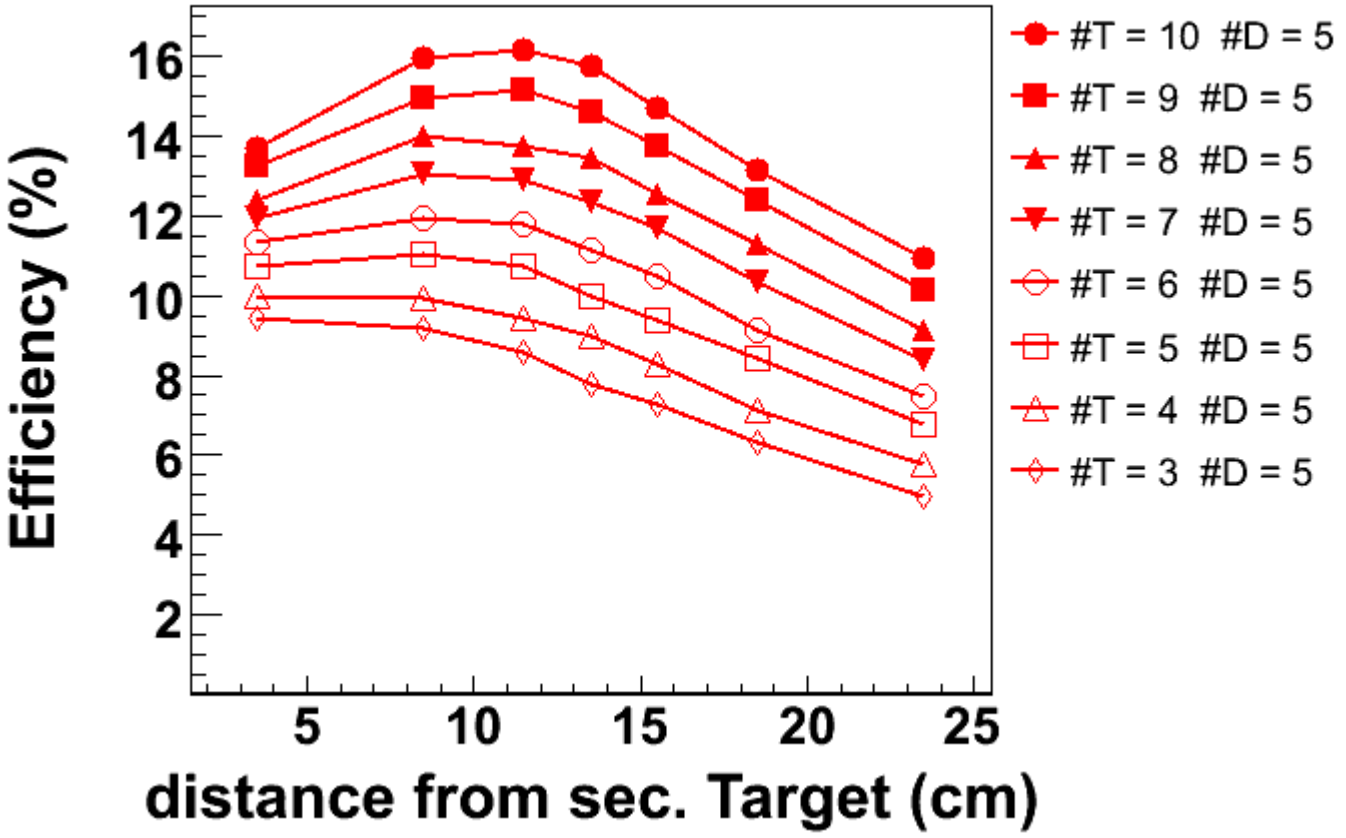

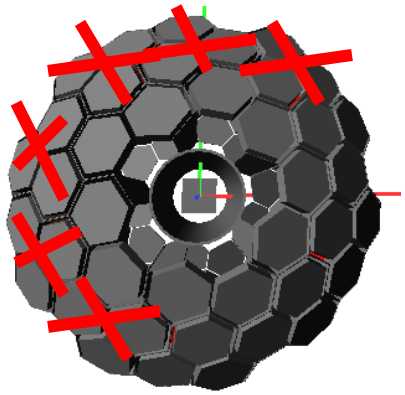

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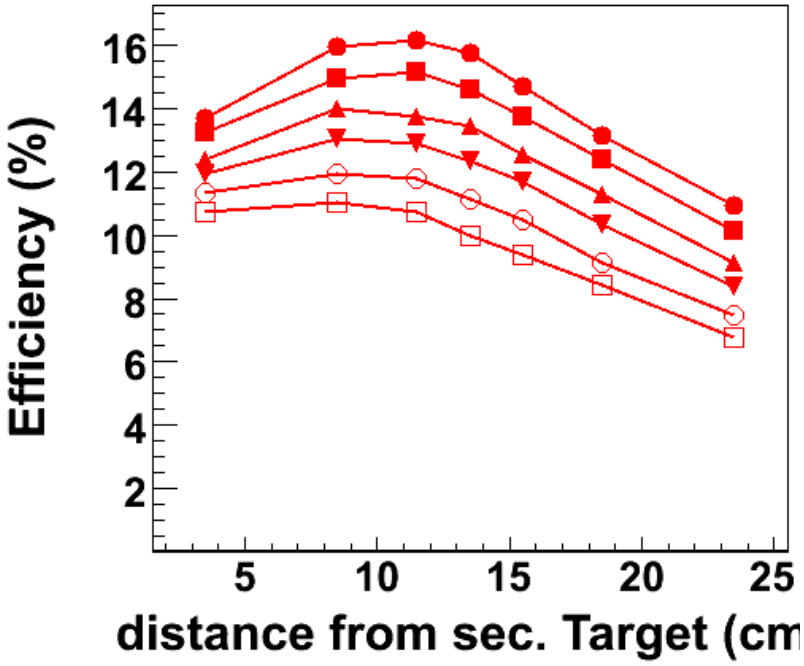
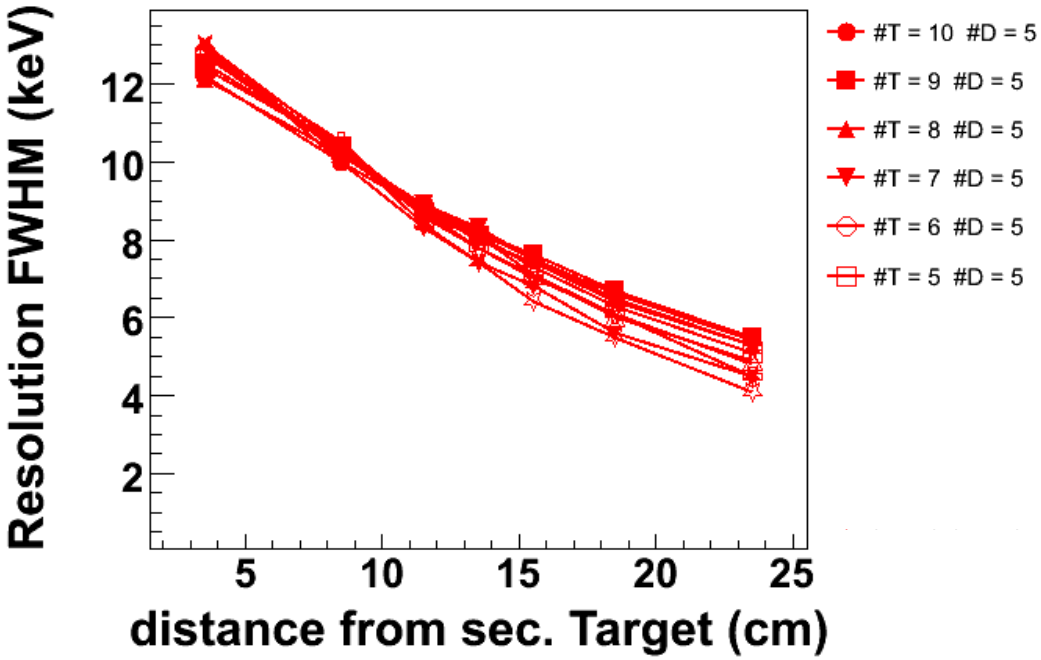
EFFICIENCY



RESOLUTION



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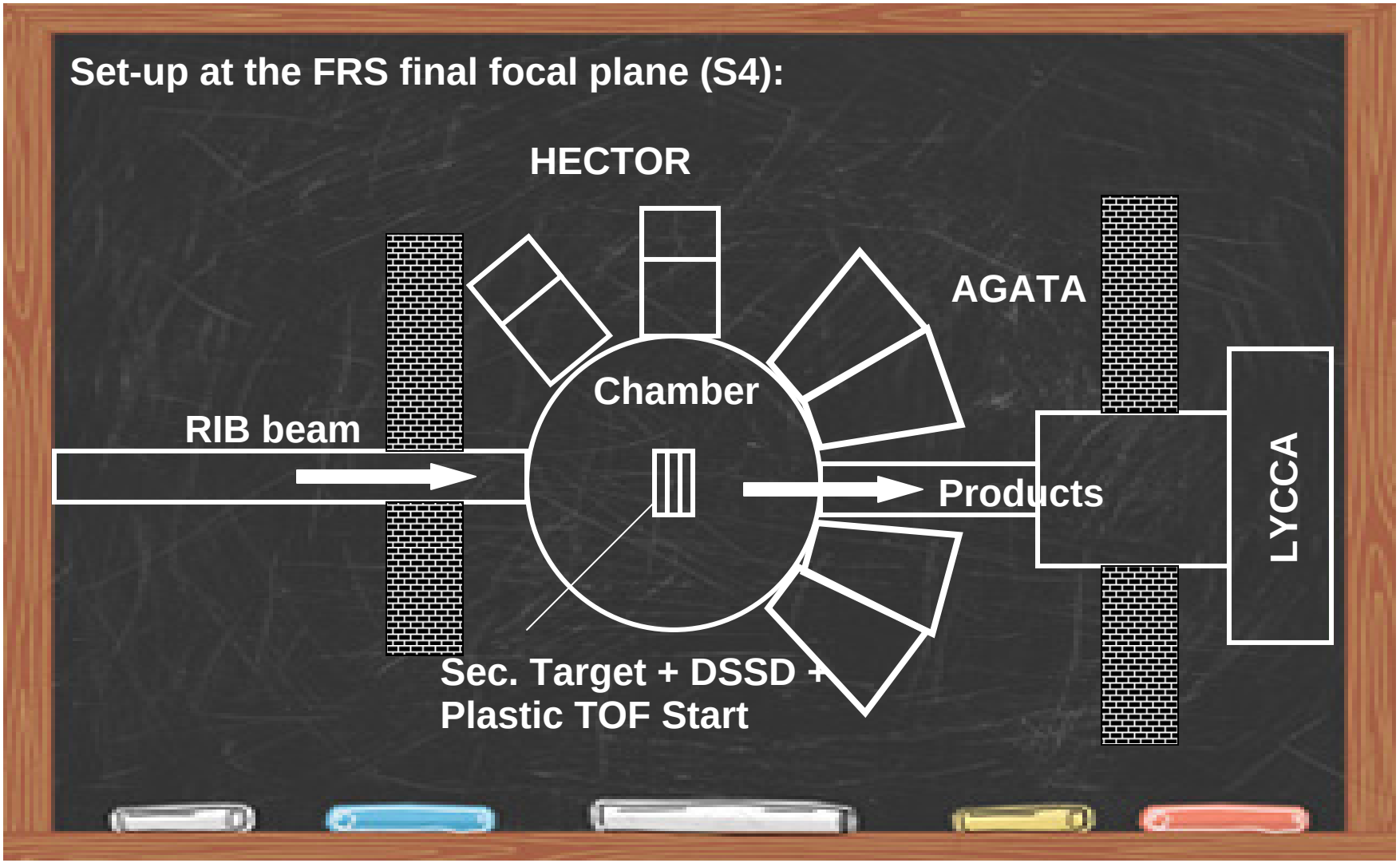
Effect of the lead absorber



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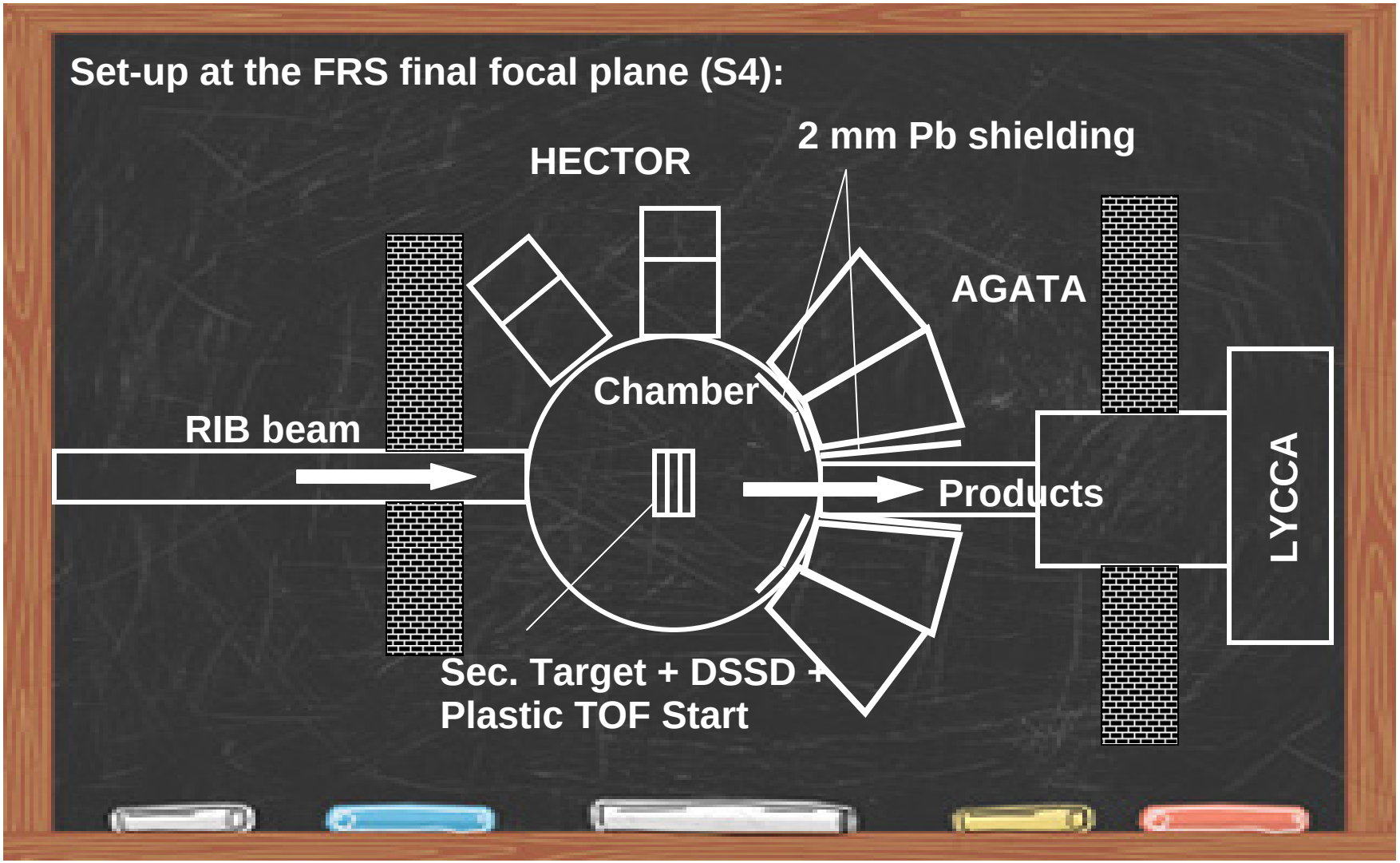
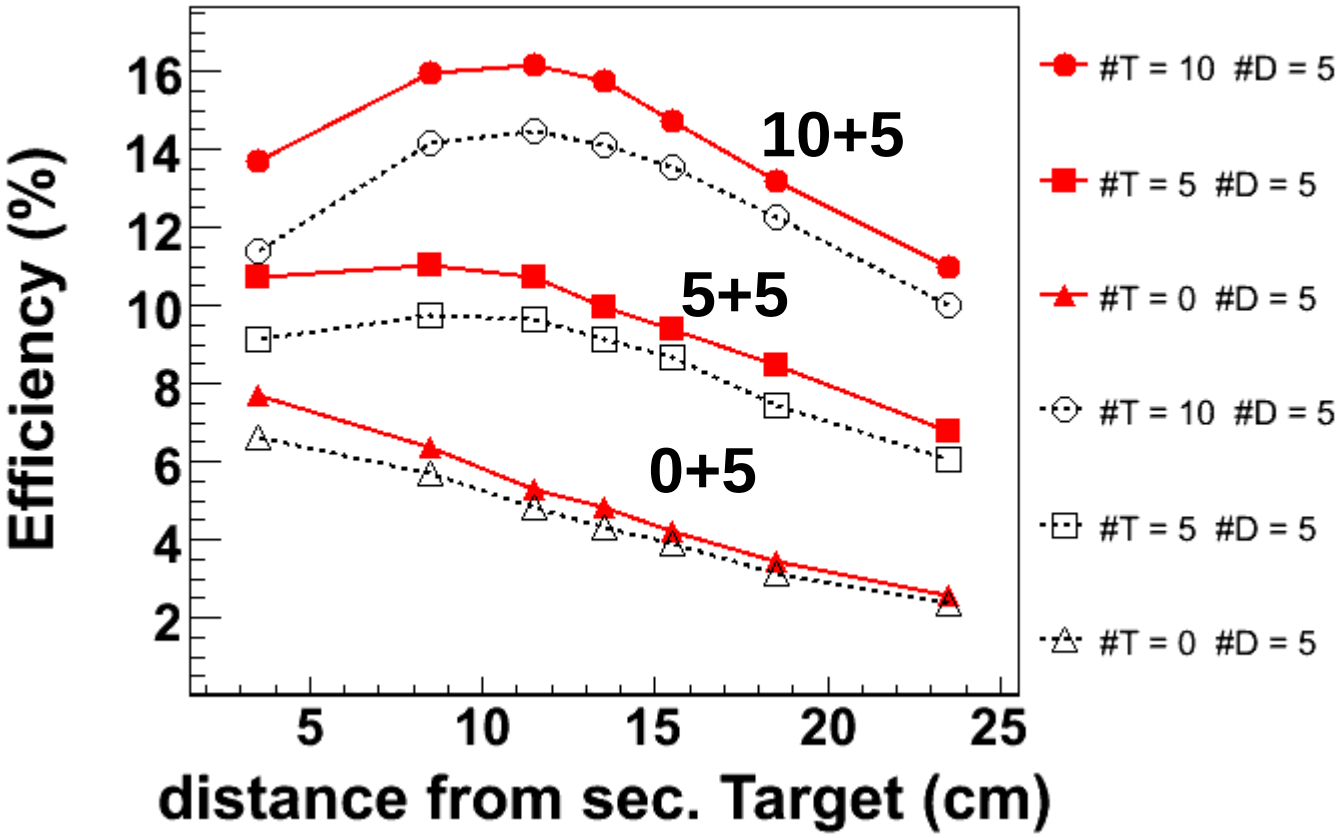


Effect of the lead absorber

No shielding

2mm Pb shielding

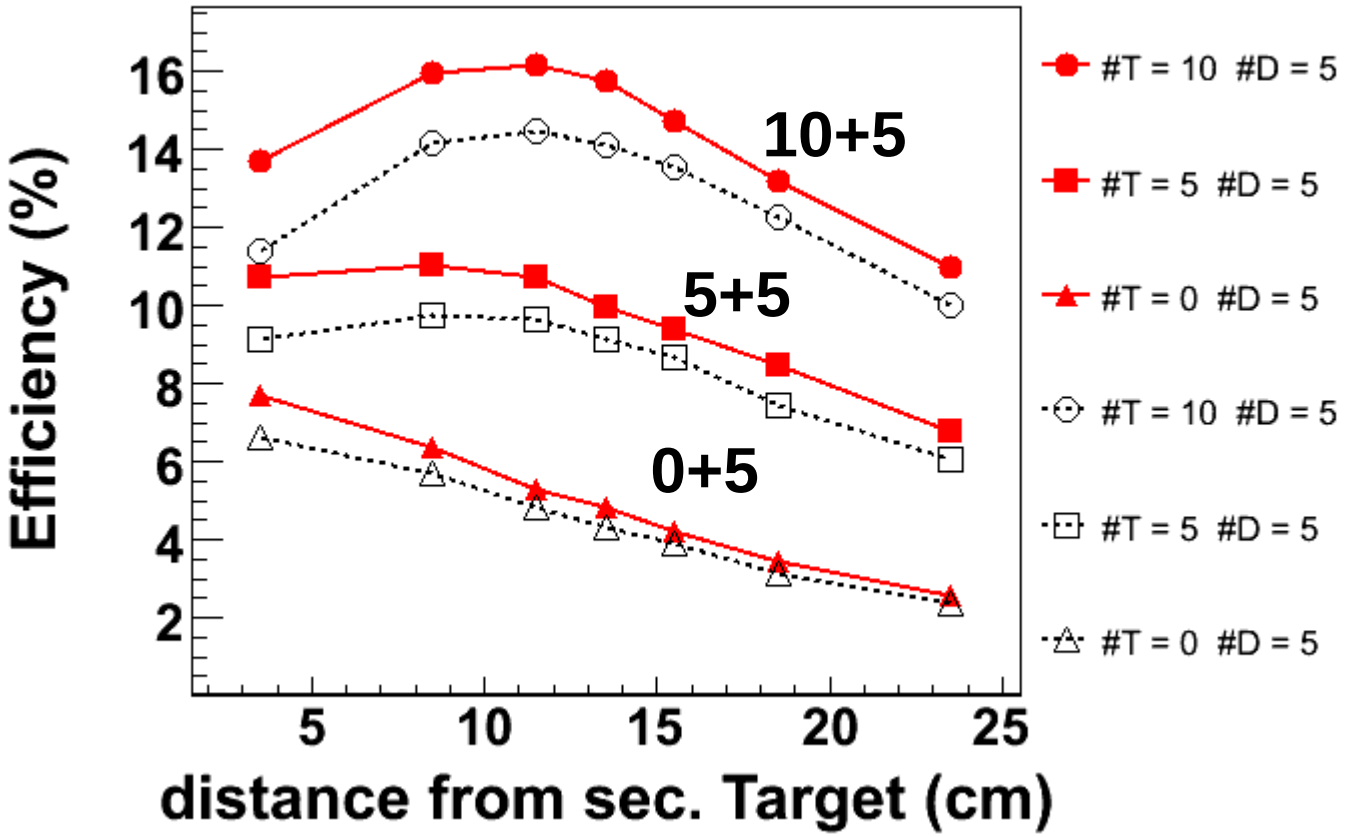


Effect of the lead absorber

No shielding

2mm Pb shielding

Really needed? how thick? → **Test it !**



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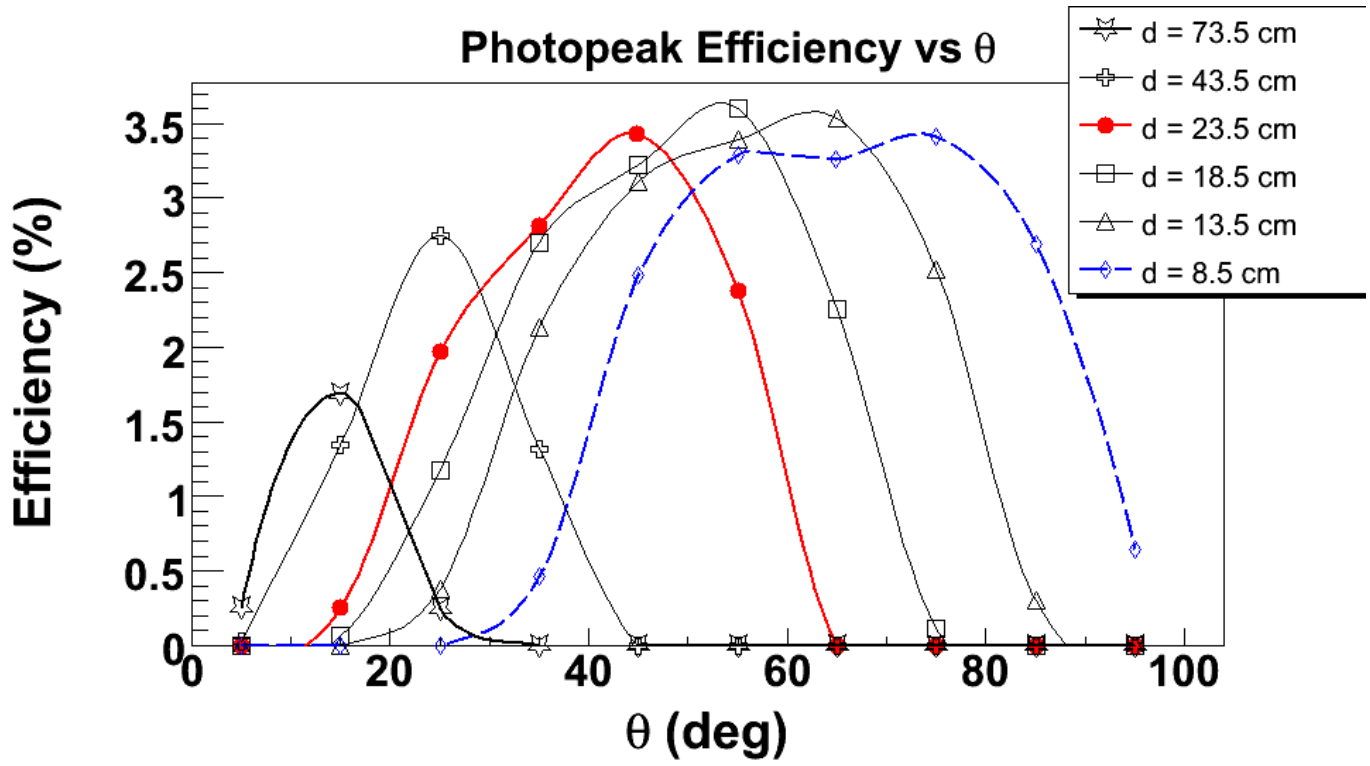

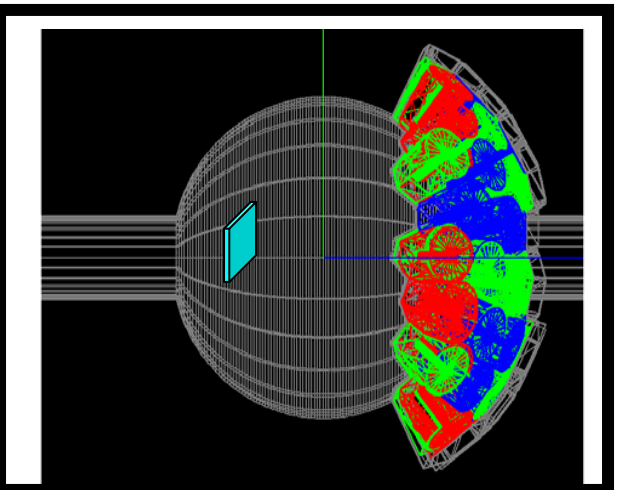

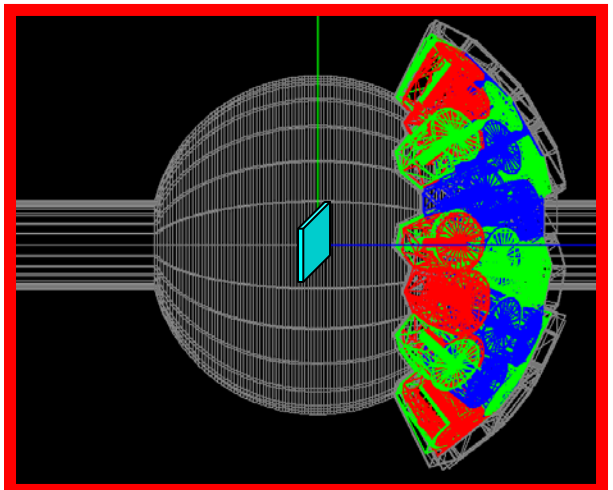

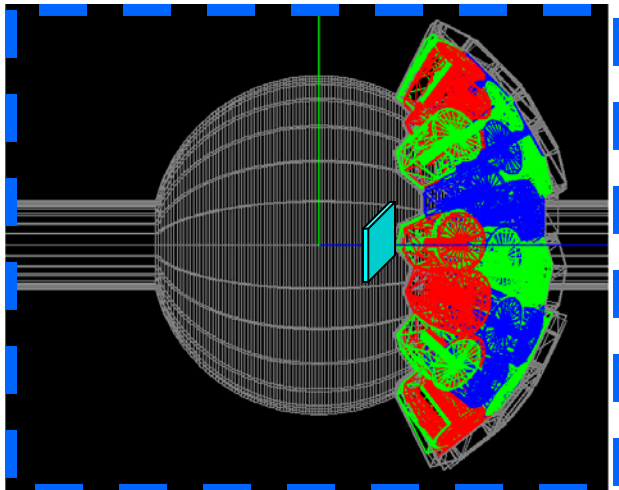

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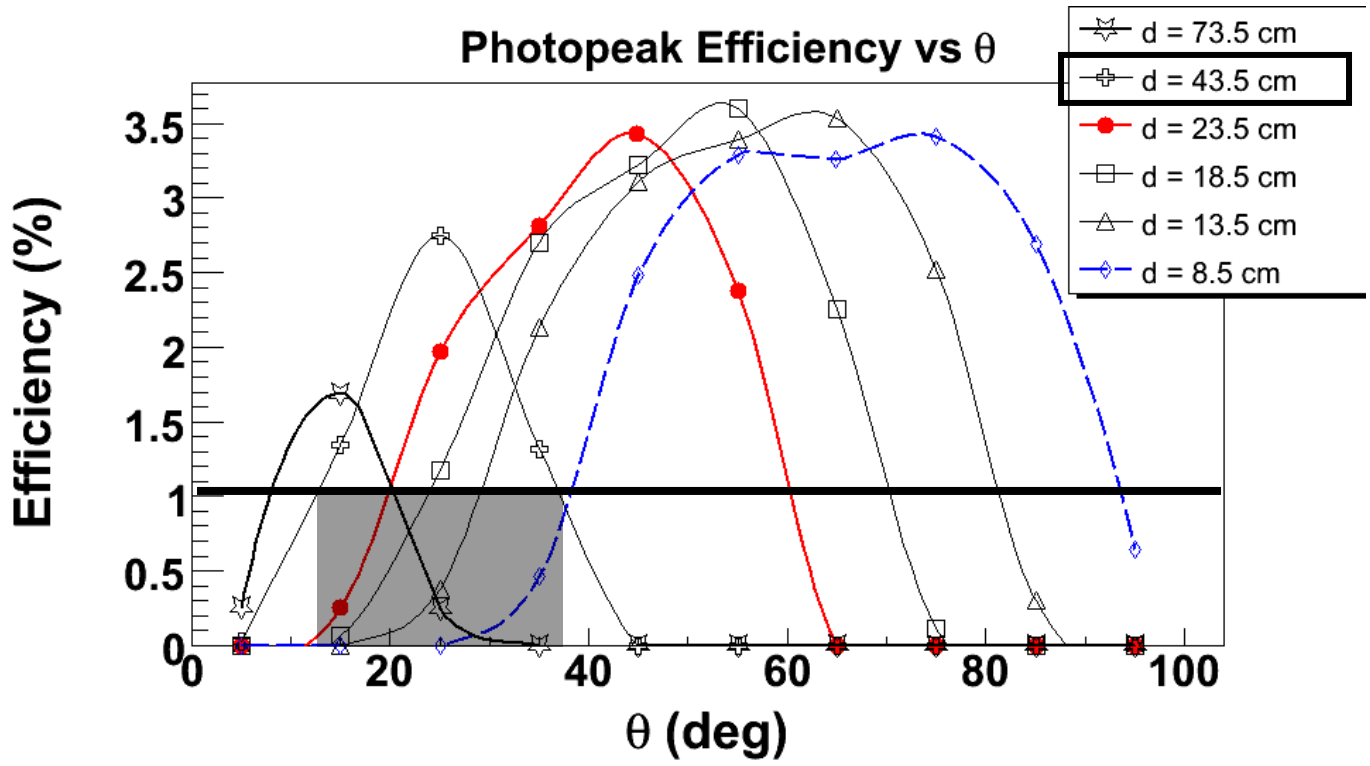
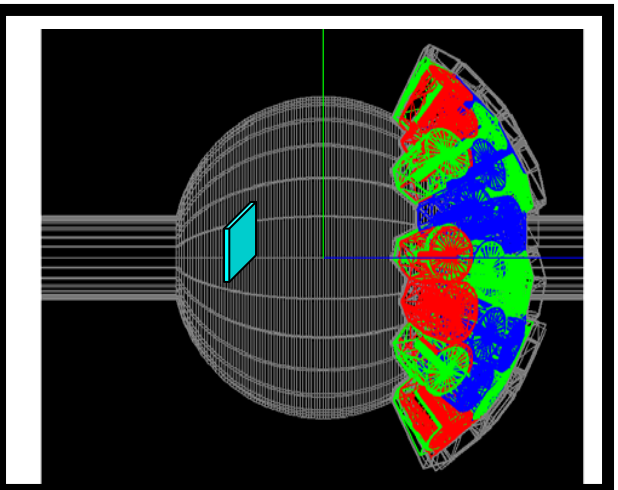
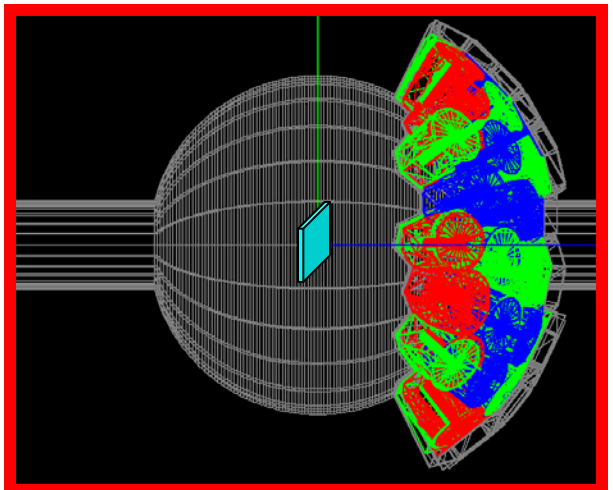
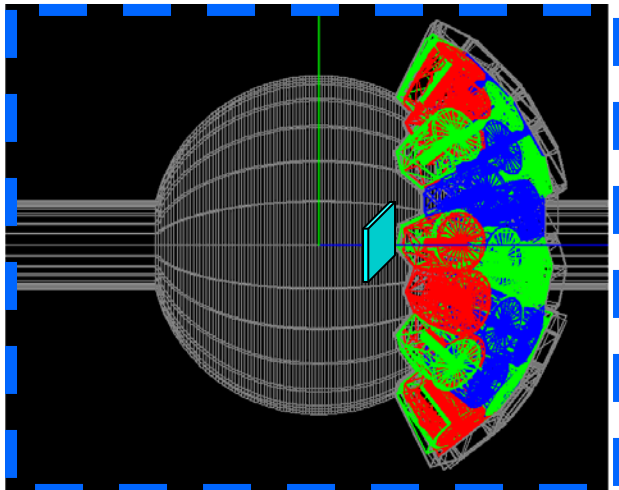
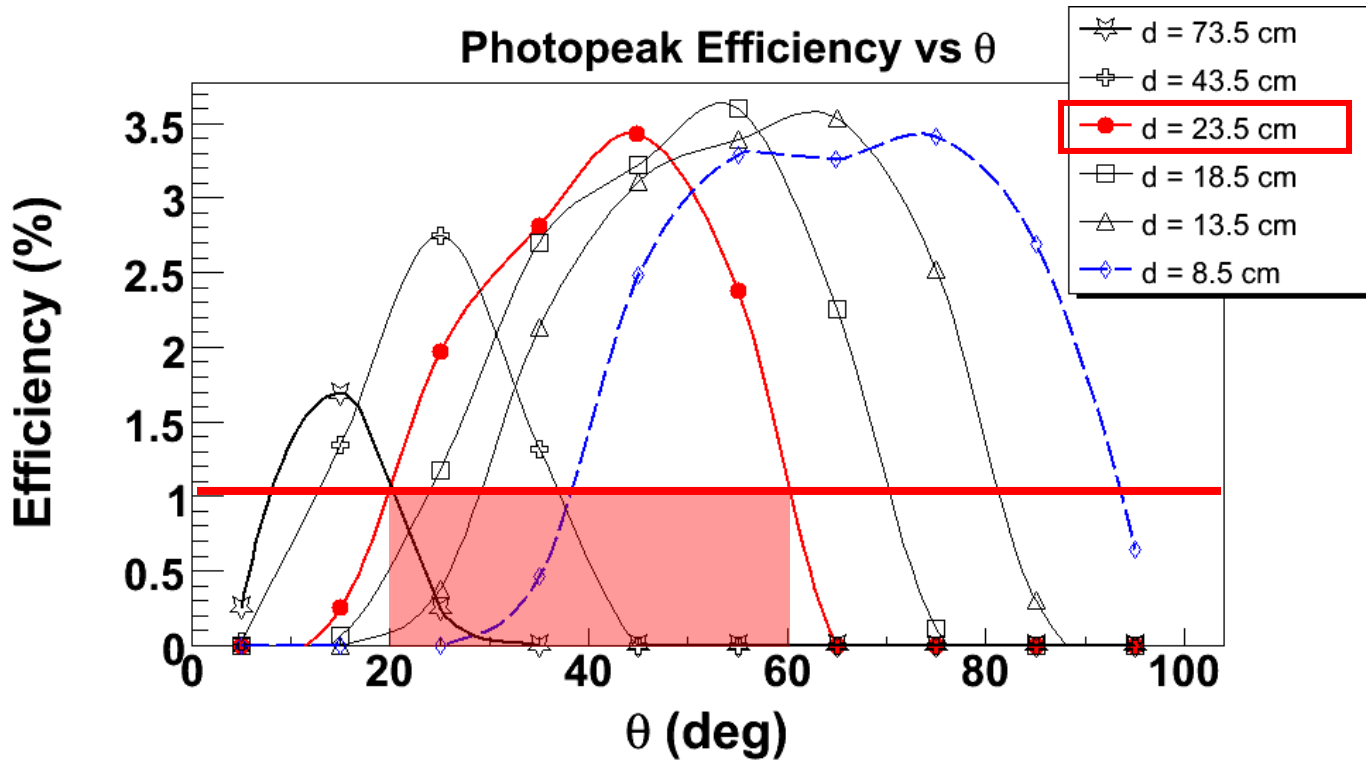


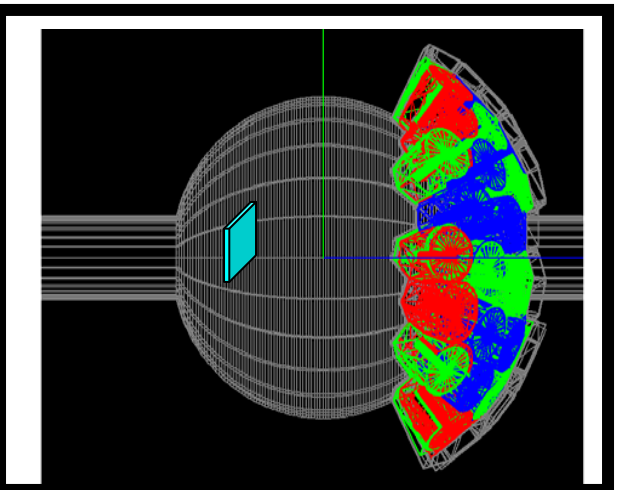


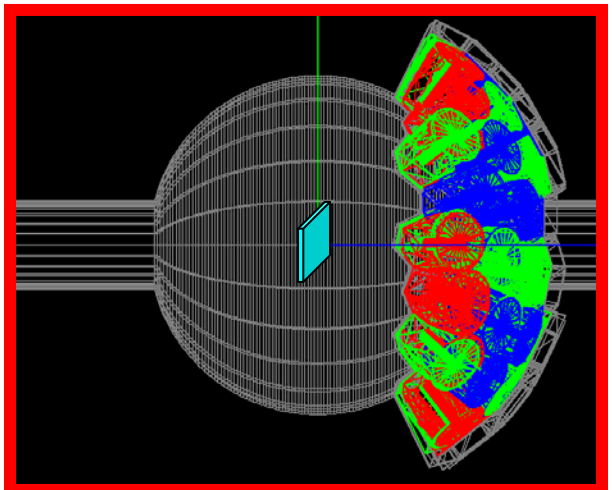


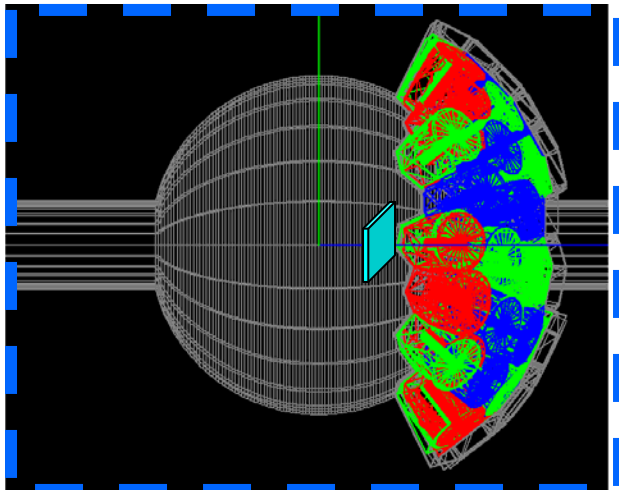


AGATA S2' @ GSI: angular dependence of the efficiency

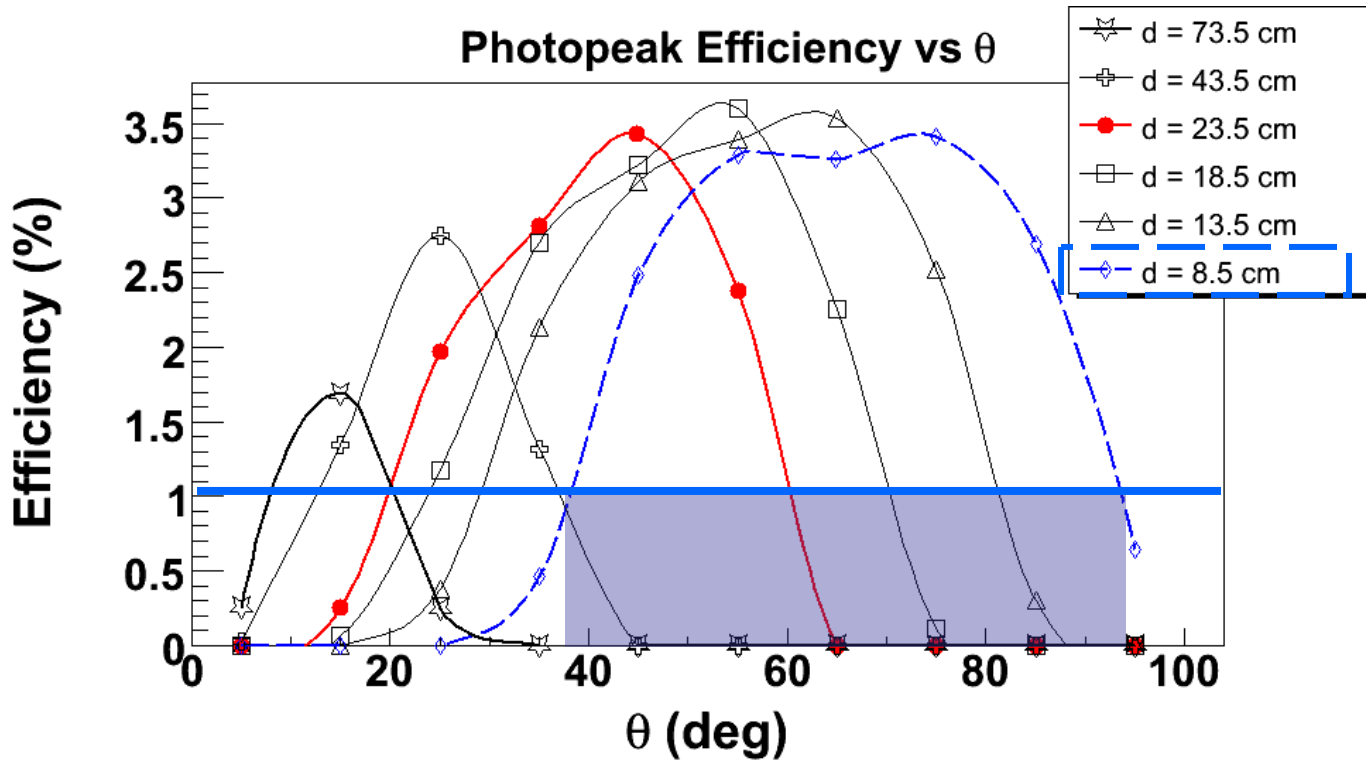


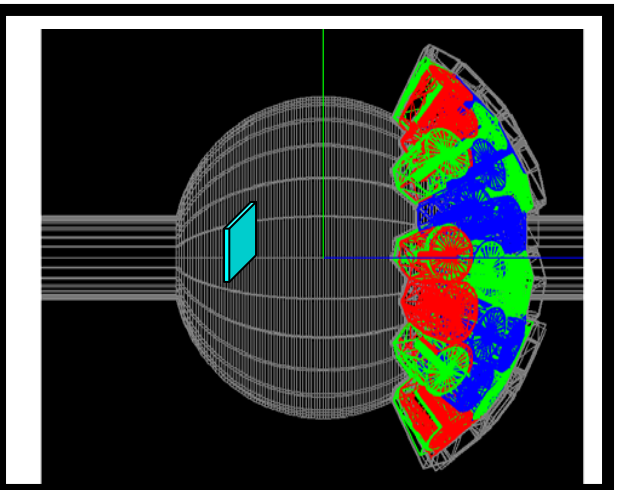


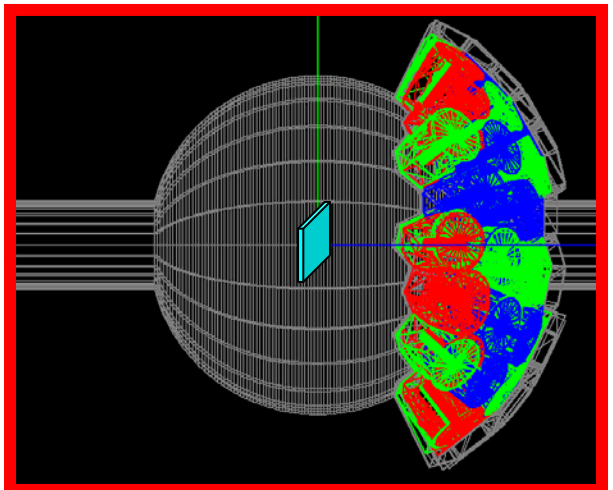


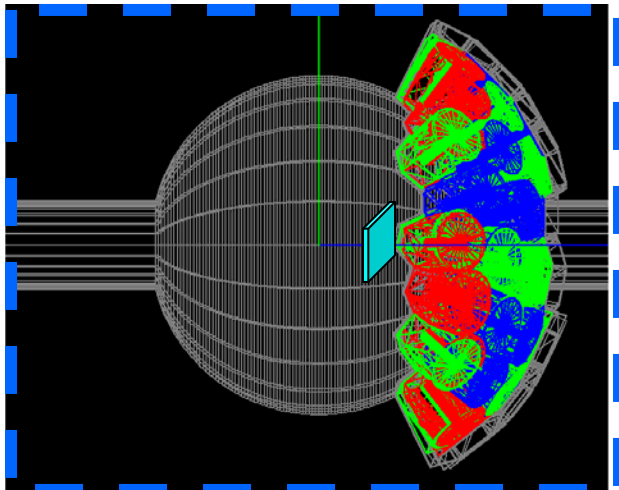


AGATA S2' @ GSI: angular dependence of the efficiency







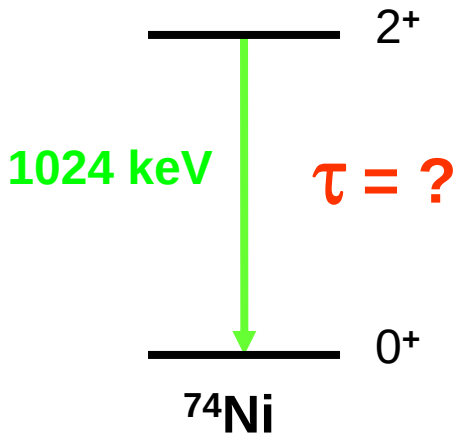


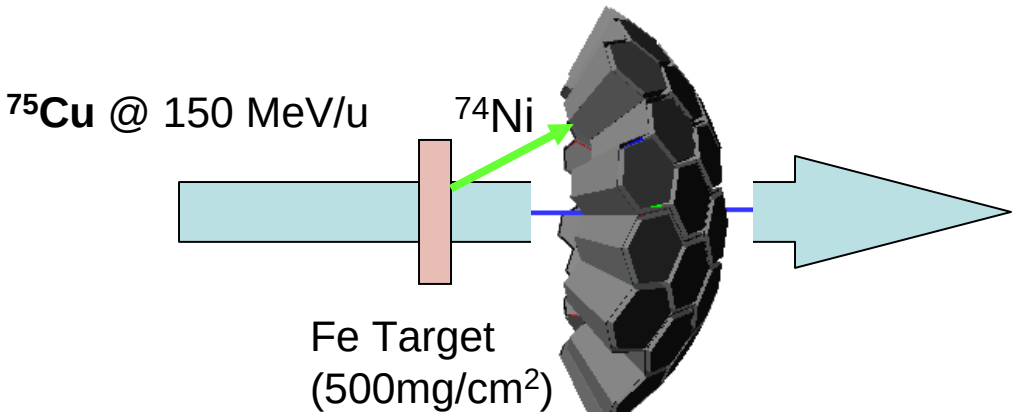
Outline

- Overview of the AGATA environment at GSI FRS (PRESPEC)
- Expected AGATA performance in terms of efficiency and resolution
- Performance vs. number of double and/or triple cluster available
- Effect of the lead (background) absorber
- Angular dependence of the g-ray efficiency for several distances
- Lifetime measurement via the line-shape effect
- Conclusion

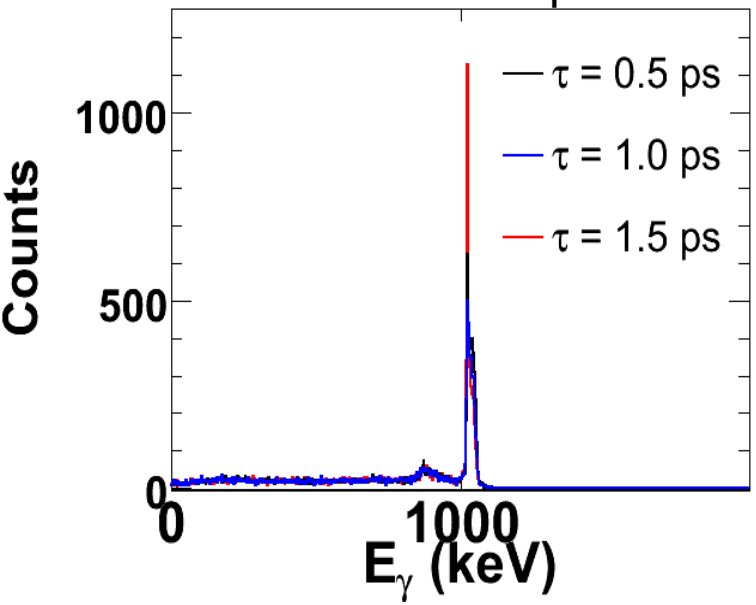
Lifetime via line-shape effect

Realistic MC Simulation of a **fragmentation** experiment: DSAM Analysis

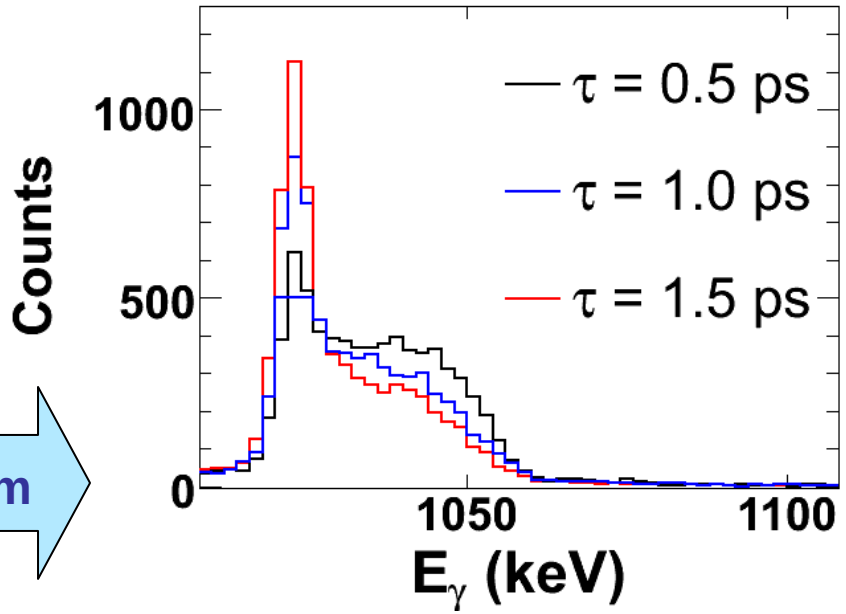




τ = 0.5 to 1.5 ps

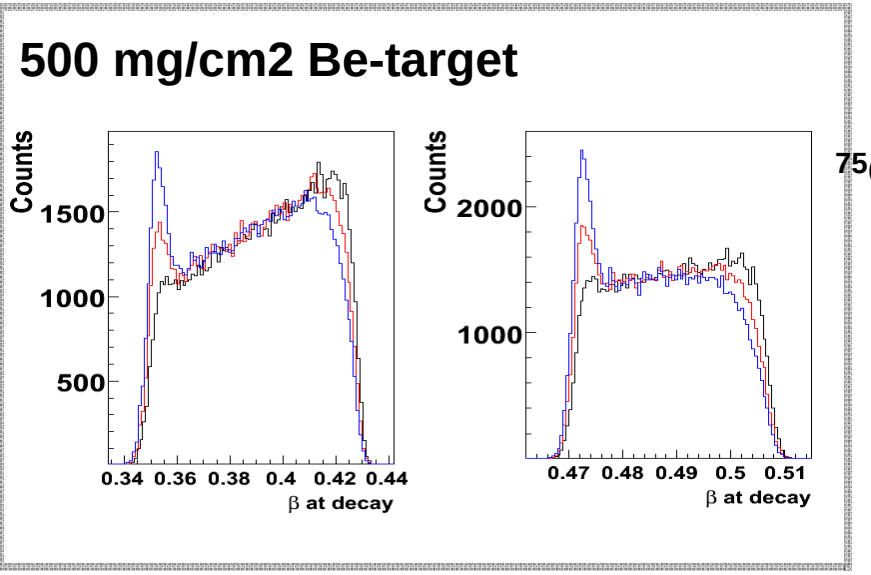


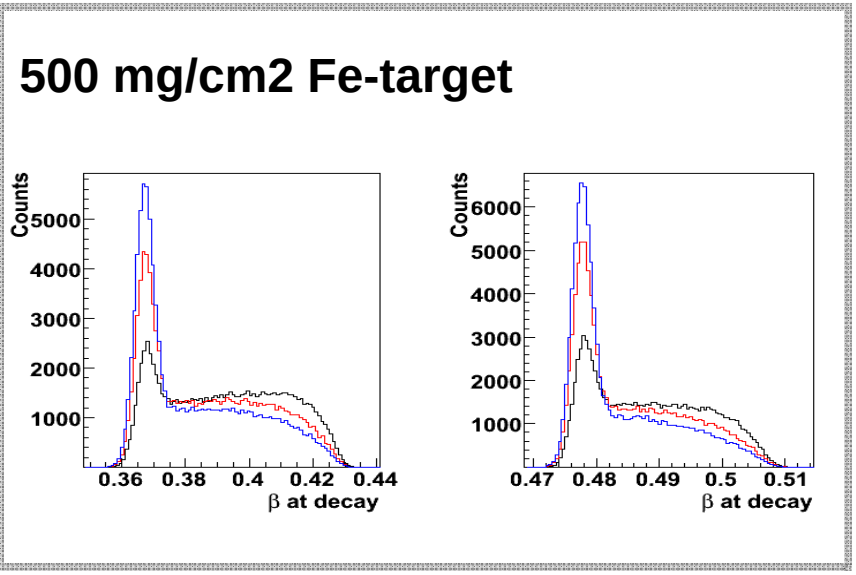
Zoom

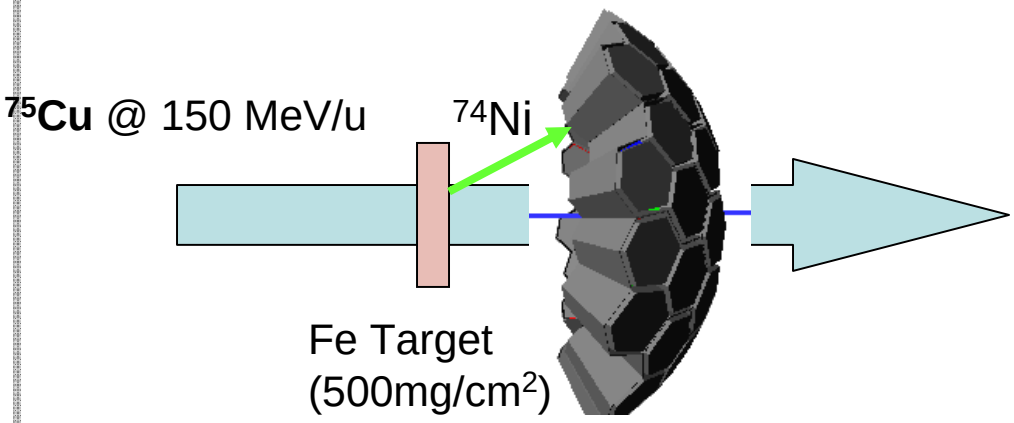


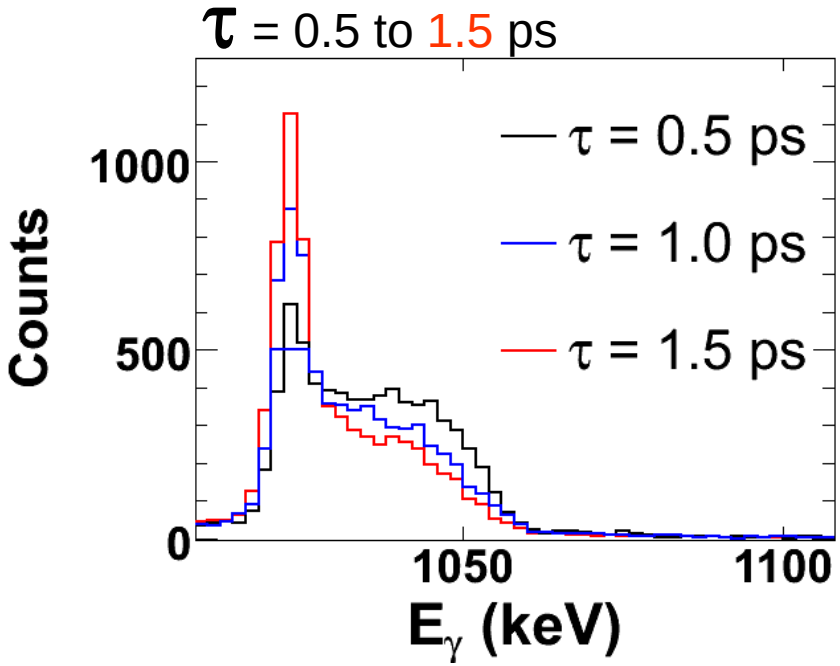
Lifetime via line-shape effect

Realistic MC Simulation of a **fragmentation** experiment: DSAM Analysis









Outlook & Conclusion

- The AGATA S2' configuration (10 ATC + 5 ADC) shows the best performance in terms of efficiency (11% to 16%) and γ-ray resolution (5 keV to 10 keV FWHM).
- Such performance represents an improvement of more than one order of magnitude in g-ray sensitivity, when compared to the present RISING-EUROBALL array.
- About a factor of two will be lost in efficiency, when only 5 double and 3 triple clusters are available. Resolution remains the same.
- The angular range between $\theta = 15$ deg and $\theta = 90$ deg can be effectively covered for target-array distances between 40 cm and 8.5 cm, respectively. Such distances are compatible with a spherical target-chamber, 46cm in diameter.
- The 2mm lead layer, foreseen for the absorption of low-energy background g-rays affects mostly to the efficiency gained by the triple-cluster detectors at large angles (> 30deg).
- Lifetime measurements via the line-shape effect seem feasible, but the setup (target material, target thickness, beam energy) needs to be optimized for each particular case.